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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

Official Organ of the Royal Aero Club First Aeronautical Weekly in the World Founded 1909

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The University of Space

IN the University of Space the senior class speaks with a Russian accent. The Americans are barely more than second-year students and, like the Russians, they seem to be reading a National Prestige Tripos comprising science, propaganda and "defence" as major subjects. Next year, on a grant from the USA, a freshman from Britain is coming up—modest in ambition and devoted purely to science, but perhaps the first of many.

In London last week, at the offices of the Royal Society and at the Royal Festival Hall, this contrast was emphasized. At the former, Professor Harrie Massey described the British experiments which (Scout booster permitting) should be launched into orbit late next year; in the latter, Professor Alla Masevich described the impressive achievements of Soviet space technology. The Soviet professor's audience comprised 2,500 people who had paid up to 15s per head to be there; those listening to the British professor amounted to some 30 scientific correspondents who had not had to pay at all.

While the immediate intentions of British scientists (through the National Committee on Space Research) in taking up the generous US offer of the "International" satellites are now clear, the question of more-ambitious future satellites, possibly launched by British rockets, is still supposedly uncertain. But it is now apparent that the official climate has changed within the past nine months, and has become distinctly favourable to the idea of using Blue Streak/Black Knight boosters for space research. The intuitive belief has grown that this will in fact happen.

For the modest but excellently planned initial British venture into space to be followed by an equally well-planned major programme, the Government's Steering Group on Space Research will have to make the basic decision before many months have passed. Already the design studies which the Ministry of Supply stated (nine months ago) would take six months to complete have apparently drifted on and may now be complete "in perhaps a year's time" (from now). The implication is not necessarily that time is being wasted, but rather that the design studies, without any official public indication having been given, are advancing to a more-detailed stage. If Britain is serious about entering the University of Space, the realistic way to do it is by decision and planning, not by a gradual drift.

Facilities and Motives

This country already possesses valuable assets in the space-research business. Both the Soviet Union and the USA agree that, in Manchester University's Jodrell Bank experimental station, we have the world's best steerable radio-telescope, the value of which has been repeatedly proved. The Radio Research Station near Slough, home of World Data Centre C for rockets and satellites, is expanding its space interests. New tracking facilities are planned.

An altogether wider effort, however, would be made possible by a firm decision to develop British boosters as satellite launching vehicles. Only then would a true Commonwealth programme make sense, for the existing machinery for international scientific cooperation—mainly through COSPAR—is indeed working well at present. And only then, presumably, would industry feel satisfied that it was being given a full opportunity to develop its talents along these directions. But the supremely important factor in deciding whether to go ahead with British satellite boosters is that of motive. The decision must be taken after realistic consideration by the Government's steering group—and not simply because of pressure from industry, enthusiasts' desires to put Englishmen in space, or wishful delusions as to national resources, power and influence.

FROM ALL QUARTERS

Westland Buy Fairey Aviation

RATIONALIZATION appears to have been taken to the point of monopoly by the announcement on February 2 of the intention of Westland Aircraft to purchase Fairey Aviation. The deal will make Westland by far the largest helicopter manufacturer in Europe, and *Flight* calculates that on certain counts they may be the largest in the world. Nevertheless, any suggestion of monopoly is nullified by the keen competition which Westland must face.

The announcement by the two companies begins in the following terms:—

"The directors of Westland Aircraft and of The Fairey Company announce that they have today reached agreement for the sale by Fairey to Westland of the issued share capital of Fairey Aviation, which operates all Fairey's United Kingdom aviation interests. The consideration will be the issue to The Fairey Company of 2,000,000 Westland shares of 5s each, credited as fully-paid, and a cash payment of approximately £1.4m. The Fairey Company will distribute to its own shareholders 1 Westland share for every 2 Fairey shares held.

"The Minister of Aviation . . . will regard the new combination as constituting a specialised helicopter group eligible for Government support. Westland has informed the Minister that it intends to carry on the Rotodyne project, and arrangements have been made for the development contract to be signed forthwith."

Under these terms—regarded as generous—Westland will buy all Fairey aircraft manufacturing business (including the Gannet AEW.3) and Fairey's investment in the Aircraft Manufacturing Company. They will maintain all the Fairey employees currently at work on the outer wings of the Airco D.H.121. The point must be made, however, that Airco is now a complex consortium, since all three of the original partners are, or are likely to find themselves, divisions of larger groups.

The sale does not include Fairey Air Surveys, nor any overseas subsidiaries. Neither does it include the works at Heston, Middx, which is, *inter alia*, the home of the weapon division, who hold a contract for research into advanced anti-tank missile systems. Fairey's remaining net worth will be approximately £9.5m; and it is their view that, as a non-aviation firm, they will be more prosperous than hitherto.

The announcement removes all doubt of the future of the Rotodyne. The Ministry of Aviation have already agreed to contribute some £4m towards its development, and under Westland's direction the programme should be able to proceed with greater certainty. As reconstituted, Westland Aircraft will incorporate all the helicopter interests of Bristol, Fairey and Saunders-Roe, although little immediate change will be apparent in the plants concerned.

Next Week's News

GRAPEVINES in the British aircraft industry have rarely been so busy as they are at the moment. Following a remarkable amount of "rationalization," the industry is now awaiting the *White Paper on Defence 1960*, due to be published next week. Some of its contents are foregone conclusions; others are by no means so certain. It is appropriate to tick off a few major projects:—

Folland (Hawker Siddeley) Gnat T.1: A substantial production order for RAF Training Command is expected. At present 14 pre-production machines are being built and the next batch is likely to be several times as large. Powerplant, Bristol Siddeley Orpheus 100.

Short Britannic: Now that Short & Harland have completed the basic design it is likely that manufacturing will be accelerated by the signing of a formal production contract. The number of aircraft involved is unlikely to be less than a dozen and all are expected to go to RAF Transport Command. Powerplant, four Rolls-Royce Tyne.

Vickers/English Electric TSR.2: This multi-purpose machine for the RAF is likely to be funded at an increasing rate, and the stage should have been reached when development machines can be ordered. Powerplant, two Bristol Siddeley advanced Olympus.

Fairey (Westland) Rotodyne: The £4m development contract (see Col. 1) was signed last Monday, and the White Paper will almost certainly announce the purchase of a batch for military purposes. The number involved is likely to be not fewer than ten. Powerplant, two Rolls-Royce Tyne.

Vickers-Armstrongs "Super VC10": Referred to in last week's issue, this civil transport is likely to be underwritten by a BOAC order. It is also so obviously an outstanding basis for a heavy military transport that a firm contract may be expected for a variant for RAF Transport Command. Powerplant, four Rolls-Royce Conway.

Hawker P.1127: The first of these tactical VTOLs is likely to fly late this summer and further development should be confirmed by an order for a number. The P.1127 is visualized as a replacement for the Fiat G.91 in NATO, but will have to fight for its place against the German design recently referred to by the Minister of Defence. Powerplant, Bristol Siddeley BE.53.

Westland Helicopters: It would be logical to expect substantial additional military procurement of such helicopters as the Gnome-Whirlwind, Wasp, Wessex and either the Westminster or Wiltshire.

D.H. Propellers Blue Streak: Notwithstanding the obvious shortcomings of a fixed-emplacement weapon system (see page 200) there seems no doubt whatever that Britain's LRBM will be continued as a high-priority weapon. Several firings should take place this year and, as the programme moves further into the hardware stage, funding is likely to be accelerated.

Other Missiles: The outstanding recipient for increased money is likely to be the English Electric Blue Water. Procurement will also undoubtedly be hastened of either (or both) the Bloodhound Mk 2 or Thunderbird Mk 2, which are now partners in the same manufacturing group of companies. It is also possible that a Government order may be placed for Tigercat and/or a British anti-tank missile.

Hawker Siddeley Mergers

AT an extraordinary meeting of the Hawker Siddeley Group last week, shareholders approved a proposal to raise the capital of the group by £12m to £57m. This money will assist the group to take over the de Havilland Enterprise and the Blackburn group. The voting figures for Hawker Siddeley's offer to acquire the latter were: D.H. ordinary, 78.8 per cent; D.H. preference, 84.7; Blackburn ordinary, 87.2.

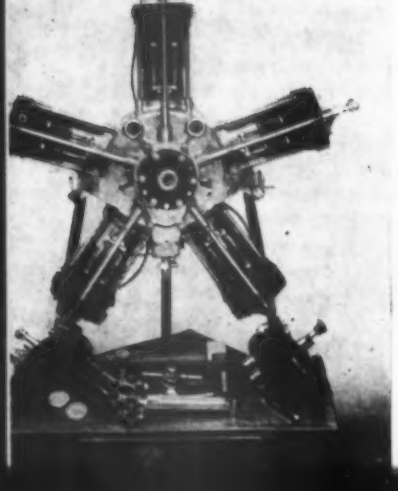
Record Engine Sales

ANOTHER aviation exports record was set up last year, British aero-engines and spares earning £64,505,981 in overseas business. This was an increase of 30 per cent over the previous highest total, achieved in 1958, whose figure exceeded 1957's by 22 per cent. The 1959 sales of engines and parts, representing £1,230,000 a week, comfortably exceeded total annual aviation exports for every year except one from 1946 to 1954. Since the war, sales of spare aero-engines and parts have totalled £282,283,692. These figures do not take account of royalties earned from the licence-manufacture abroad of British powerplants.

Admiral Sir Murray Sueter

IT is with regret we record that Rear Admiral Sir Murray Sueter, CB, RN (ret), who established the RNAS in the First World War and put forward the idea for the first torpedo-carrying seaplanes, died on February 3 at the age of 87.

His first official contact with aviation was in 1908, when he left the Fleet to become Inspecting Captain of Airships; then three years later his duties were enlarged when he was made Director of the Air Dept. When the RFC was formed in 1912 he set up its Naval wing, which soon became known as the RNAS; in 1914 he took Naval flying men to Belgium as support for the RN Division's efforts to prevent the fall of Antwerp; and in 1915 the value of his air-launched torpedo idea was vindicated when three enemy vessels were sunk by this means in the Dardanelles. In the latter year, he was made Superintendent of Aircraft Construc-



***VETERAN VIALE:** This five-cylinder Viale engine first flew in a Blériot in 1911, then in an Avro biplane and monoplane in 1912, and finally in the Bristol Babe of 1919. Lately retrieved from a Bristol garage by G. Wansbrough-White (writer of the article on pages 205-212 of this issue) and C. H. White, it has been cleaned by Bristol Siddeley and will be presented to the RAeS Nash Collection*

***ROUND THE HORIZON**—Sperry artificial, on a test table—are members of an Argentine technical mission who recently visited the Sperry Gyroscope Company's works; they are seen with some of the executives. Third from left is the Argentine Air Attaché, Air Cdre A. R. Sola Claret*

tion; and in 1916, when the RFC was being hard pressed, he directed that new Sopwith fighters ordered for the RNAS should be transferred to RFC squadrons. In 1914, at Winston Churchill's instigation, he had gone to Frederick Handley Page and asked him to design an aircraft to bomb Berlin. "People called me the biggest damn fool," he used to say; "but at the end of 1915 we got the Handley Page O/100 which, with its still larger successors, gave most valuable results."

Sir Murray commanded RNAS units in Southern Italy from 1917 to 1918; and in the inter-war years, when an MP, he had much to do with the development of Empire air-mail services.

RAE College Swan-song

THE final prize distribution of the Royal Aircraft Establishment Technical College, Farnborough, prior to its "integration" with the new Farnborough Technical College, took place on Friday last, February 5. Prizes and certificates were presented by Sir Owen Wansbrough-Jones and, in the absence of Sir William Farren (chairman of the college advisory board) abroad, a message from Sir William was read by Sir George Gardner. Among the awards was the Grinsted Prize for the best student of the year, to J. K. Ratcliffe.

A tribute to the work of the College Principal, R. D. Peggs, OBE, MA, was paid by Dr M. J. Lighthill, Director of RAE. In Mr Peggs' report for the 1958-59 session—his fifteenth annual report—he included an historical review of college activities since its forerunner, the Trade Lads' School, was formed in 1918. The college received its present designation in 1945. The final section of the Principal's report was a statement of his personal educational philosophy and a plea for technological humanism. Technology concerned itself with the creative acts of man, Mr Peggs said; it involved the handling of ideas and the establishing of values, and it offered social coherence.

"FLIGHT" NEXT WEEK—a feature issue with emphasis on the important and topical subject of flying aids, and particularly on progress in automatic landing and inertial-navigation systems. Usual features will also appear.

Louis Blériot Speed Cup

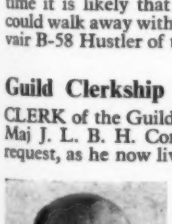
ORIGINALLY created by Louis Blériot in 1930, an international speed contest for the first person to fly at 2,000km/hr (1,243 m.p.h.) over a specified closed circuit has been re-opened under the auspices of the French Aero Club. The prize is "a challenge cup valued at 10,000 new francs" and the circuit must be "of such a length that the time needed to complete the circuit shall be at least half an hour." Intermediate landing or flight refuelling is not allowed; assisted take-off is permitted, but the machine must not be carried by another aircraft.

The prize will be won outright by any contestant achieving 2,000km/hr under these conditions. The first to attain 1,500km/hr (932 m.p.h.) will be the provisional holder of the cup until his speed is bettered by at least 5 per cent, and this will continue until the 2,000km/hr figure is reached. If this upper target has not been achieved by December 31, 1963, the provisional holder will become the outright winner. Entrants should hold a current FAI international sporting licence, and enquiries in this country should be addressed to the Royal Aero Club.

The obvious comment to make is that the critical factor in the conditions is endurance. "At least half an hour" would rule out many of the aircraft which have already demonstrated their ability to achieve 2,000km/hr over closed circuits. In fact, at the present time it is likely that there is only one Western aeroplane which could walk away with the cup tomorrow; that aeroplane is the Convair B-58 Hustler of the US Air Force.

Guild Clerkship Changes

CLERK of the Guild of Air Pilots and Air Navigators since 1956, Maj J. L. B. H. Cordes is to retire from that office at his own request, as he now lives in Gloucestershire and finds it difficult to keep up with the duties at long range. V. C. Varcoe, OBE, ARAeS, is taking office as honorary clerk.



V. C. Varcoe

Maj Cordes, who has had a long and distinguished flying career, with the RFC and RAF and later in industry as a research and experimental test pilot, is a founder-member of the Guild, was a member of the first Court, later became a Warden and was one of the Guild's first liverymen. He advised hundreds of pilots and navigators in their employment and resettlement problems after the war, and was appointed Secretary to the Guild in 1950. Soon after he assumed office as clerk in 1956 the Guild became a Livery Company, and since that time Maj Cordes has been responsible for guiding the Court in matters of City practice and ceremonial.

Mr Varcoe joined the Guild in 1952 and was made a liveryman shortly after it became a Livery Company. He has served on the Court since 1956 and is a former chairman of the Guild's functions and ceremonies committee. His impending retirement from the post of aviation sales manager of Shell Mex and BP Ltd will enable him to carry out the duties of clerk to the Guild. He qualified as a pilot in 1918, served with the RFC in the First and the RAF in the Second World War (retiring with the rank of wing commander), and is still an active pilot.

***GETTING TO KNOW** the cockpit layout of the Bristol Type 188 supersonic research aircraft is Godfrey Auty, deputy chief test pilot of Bristol Aircraft Ltd. Mr Auty, who will make the first flight later this year, is seen with the full-scale mock-up at Filton*

Roly Falk: Mexico Post

WELL KNOWN as the former Avro chief test pilot, Roland J. Falk has joined the staff of Hawker Siddeley Aviation as sales executive for Central and South America. Based in Mexico, he will be responsible for the sales of civil aircraft, particularly the A.W.A. Argosy and Avro 748.

"Roly" Falk joined A. V. Roe & Co Ltd in 1950 and took over development flying of the Avro 707 series of research aircraft which preceded the Vulcan, piloting the latter (which he rolled spectacularly at the 1955 SBAC Show) on its maiden flight on August 30, 1952. He was made Superintendent of Flying in 1954, then in 1958 left active flying to undertake special duties in the field of Avro civil aircraft sales.

In prewar years, from 1936 to 1939, he was a test pilot for the ARB; then during the war chief test pilot at the RAE Farnborough, being awarded the AFC and Bar. In 1952 he was made an OBE.

IN BRIEF

It has been officially announced that the 24th Paris Aero Show will be held at Le Bourget "during the spring of 1961."

Saunders-Roe (Anglesey) Ltd have changed their name to Saro (Anglesey) Ltd. Organization and policy remain unchanged.

The Bundeswehr has increased, from 200 to 282, the number of Fiat G.91 tactical aircraft to be built under licence in Germany. An additional 50 are being delivered from Fiat.

Sir Thomas Sopwith, chairman of the Hawker Siddeley Group, is being entertained by the Royal Aero Club at a dinner on April 26 "in recognition of the fiftieth anniversary of his receipt of an aviator's certificate and of his many services to aviation." Other holders of 1910 certificates will also attend the dinner.

For many years the value to a strategic bomber of "window" or other chaff material has been reduced owing to the fact that it is always being left behind. The forthcoming Boeing B-52H, powered by Pratt and Whitney TF33 turbofans, will carry small containers for spin-stabilized rockets which will fire "chaff" or other counter-measures ahead of it.

A Boeing KC-135 Stratotanker went out of control on the runway at Walker AFB, NM, on February 3, glanced off 14 cars and was on fire when it hit a wooden hangar. The damage caused was estimated at $5m, the hangar and two other tankers being engulfed, as were outdoor refuelling installations.

Walter Browning, FRAeS, MIMechE, MIProdE, lately director and general manager of Saunders-Roe Ltd, has joined Miles Electronics Ltd in a similar capacity. Mr Browning's experience dates from the days of Short Brothers' works at Rochester in the 1920s; later, at Belfast, he was chief designer and subsequently general manager. He went to Saunders-Roe in 1946.

Fines totalling £200 were imposed on January 28 on Robert Bell, pilot of a Messenger aircraft which became lost on a flight from Staverton to Portsmouth on November 20, 1959. He was fined £150 for operating the aircraft in a reckless manner "so as to endanger life or property," and £10 on each of five other air navigational offences. After flying over London Airport Bell landed his Messenger at Gatwick.

Missiles and Spaceflight

"Cockpit" familiarization by astronauts in the Mercury capsule is illustrated in the photographs (left and below right). Design of the capsule is outlined in the article

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PROJECT MERCURY DESCRIBED

WHEN the first man-made object was hurled into orbit just over two years ago few doubted that a manned vehicle would not *ultimately* be rocketed into near space, there to take its place—temporarily at least—as a satellite of the planet on which we live. But in those early days after the dawn of the space age it appeared that *the* day on which man would make his momentous journey was, if not far in the future, perhaps a decade away. Such conservative speculations were to be rudely shattered, however, as news of active man-in-space programmes soon emanated from both Russia and the USA.

Details of Russia's specific efforts, as is customary with most of her military/scientific work, have been slow in forthcoming (*Flight*, February 5). On the other hand, Project Mercury, the American manned satellite project, has been a widely discussed and much heralded topic of technical and popular conversation. The most recent data on the Mercury programme were released during last month's annual meeting of the Institute of the Aeronautical Sciences in New York City. Forming one of the most complete and comprehensive man-in-space pictures yet given, the technical treatises on Mercury* presented by NASA authors at that meeting are summarized in the paragraphs which follow.

Objectives, Principles and Methods. The basic objectives of Project Mercury are the achievement of orbital flight and recovery of a manned vehicle, and the study of man's ability to function in the environment of the flight. The basic principles employed in getting the project under way were to use the simplest and most reliable approach, to keep new developments to a minimum, and to base the flight test programme on a progressive build-up of tests. To carry out these requirements, it was decided to utilize a ballistic-type re-entry vehicle; an existing ICBM booster—the SM-65 Atlas—for propulsion; and to use parachutes as a landing system. Finally, it was decided to provide a complete escape capability during any portion of the boosted portion of flight, since it was recognized that the boosters might not be completely reliable.

Although each of the above ground-rules have been strictly adhered to throughout the programme, one need only consider the extreme flight environment and mission requirements to appreciate that the resulting Mercury capsule design involves a certain amount of complexity. In particular, the severe noise and vibration problems associated with rocket-powered ballistic vehicles had not previously been encountered in the design of a manned system.

Capsule Configuration. Externally, the capsule is shaped rather like a truncated cone (see drawing and photographs). Re-entry is accomplished with the blunt end forward. A glass-fibre heat shield protects this end from the searing temperatures experienced during descent through the atmosphere. Heat dissipation on the afterbody (the narrow end) is by radiation. This portion of the capsule is fabricated from 0.01-inch-thick cobalt alloy shingles, corrugated for additional stiffness. Equipment bays are located on either side of the pilot. The main and reserve parachutes are stored in the cylindrically shaped afterbody. Two horizon scanners, which establish vertical and azimuth references, are located in the compartment at the very end of the vehicle. Underneath the overlapping shingles is a pressure vessel made of double thicknesses of 0.01-inch titanium sheet.

Inside the capsule the pilot sits with his back to the heat shield. In the pilot's right hand is a three-axis "side-arm" controller, which is used for attitude control. His left hand-grip is the abort initiation switch, and directly in front of him is the instrument panel and periscope display. This layout provides the pilot with approximately the same amount of room as contemporary fighter aircraft.

On the left side of the control panel are the instruments and controls for attitude reference and retro-rocket firing. Two large "handles" are also provided for decompression and repressurization. Decompression would be the method used for extinguishing a cabin fire. Alongside these handles is a sequencing display which indicates whether the flight has gone according to plan. Green lights indicate that the particular sequencing functions have been performed on schedule; red lights indicate a failure in automatic sequencing operations. A further handle is included to allow the pilot to override the sequencer and correct some failure to function.

Should the mission be aborted for some reason, an "abort" light flashes to warn the pilot. The pilot himself can abort the operation by means of his left-hand stick grip, however, if abort does not automatically occur in an emergency. A "ready" switch, installed beneath the abort light, is used to actuate a "ready" light in the blockhouse.

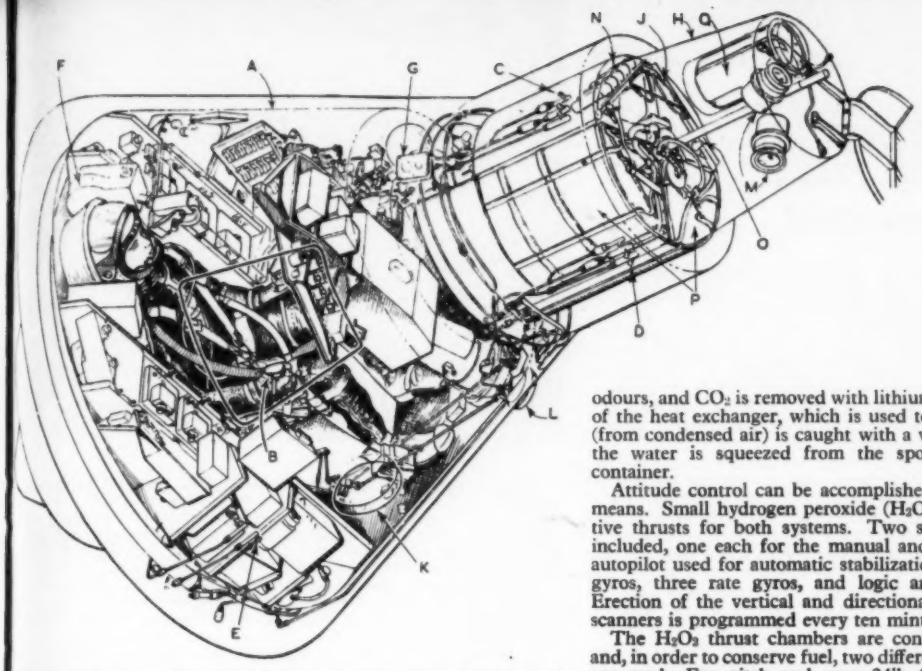
On another set of dials the pilot can ascertain his vehicle acceleration, rate of descent, altitude, and the fuel supply in the H_2O_2 tanks. The top centre of the panel is used for attitude display. This combination display indicates rate (of rotation) and attitude in pitch, roll and yaw. The rate display is in the centre, surrounded by the attitude display which consists of three dials (one for each axis). A periscope, centrally located below the panel, and a window, located directly above the panel, permit the pilot visually to establish ground reference. The pilot can also see the horizon behind the capsule during orbit and retro-firing. The instrument in the left centre of the panel is a dead-reckoning device which consists of a small model of the Earth, clock-driven to rotate in time with the orbit. On the right centre is the satellite clock which, in addition to firing the retro-rockets, indicates time of day, elapsed time since launch, and "time to go" before retro-rocket firing.

Also on the right side of the panel are a series of warning lights which will flash should a system failure be sensed. An audio alarm will come on simultaneously but may be switched off by separate switches for each type of failure. A number of critical fuses are located at the extreme right of the panel.

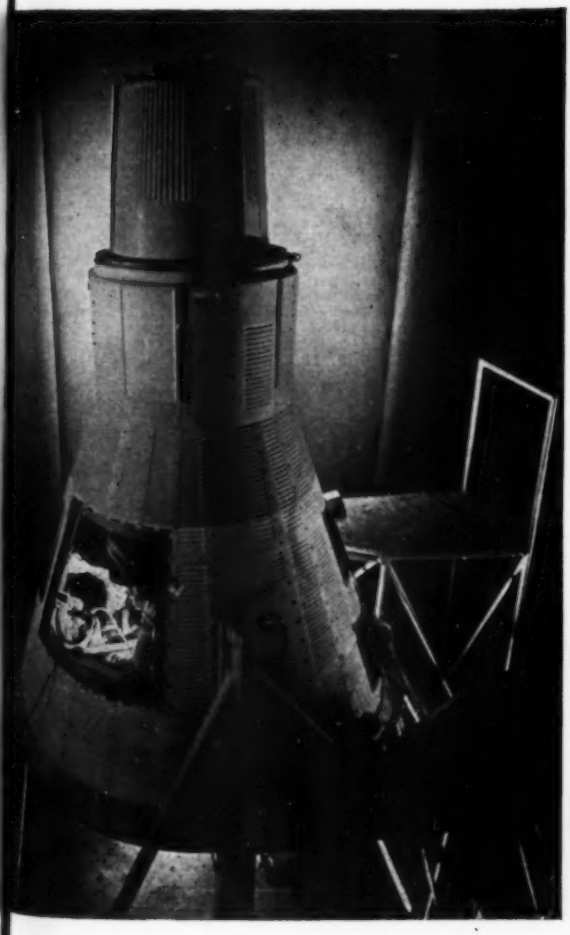
The environmental control display is in the upper right-hand section of the panel. This system indicates cabin pressure and temperature, and partial pressure of O_2 and CO_2. Directly beneath this display is the power panel, giving electrical power-system information. Still further below are the communications controls.

Two control loops, the "cabin circuit" and the "suit circuit," comprise the environmental control system. The former circuit provides for cabin cooling, while the suit circuit not only cools the air but removes odours, CO_2 and H_2O, and replenishes the oxygen that the pilot has consumed. In orbit, the astronaut breathes pure oxygen at 5lb/sq in. He wears a pressure suit which remains deflated unless the cabin pressure should fall below 5lb/sq in. An activated charcoal bed is employed to remove

*"*Mercury Capsule and its Flight Systems," by M. A. Faget and R. O. Piland; "Review, Scope and Recent Results of Project Mercury Research and Development Program," by A. C. Bond and A. B. Kehlet; "Review of the Operational Plane for Mercury Orbital Mission," by C. W. Mathews.*



Internal arrangement of the Mercury capsule: A, pressurized area; B, right-hand "side-arm" three-axis control; C, pitch stabilizer jets; D, yaw stabilizer jets; E, roll stabilizer jets; F, instrument panel recording camera; G, S-band and C-band radar beacon; H, multiplexed antenna cone; J, monopole antenna; K, window; L, periscopic port; M, horizon scanners (two); P, main and reserve parachutes; Q, drogue parachutes; N, smoke generators (five); O, flashing light



odours, and CO_2 is removed with lithium hydroxide. Downstream of the heat exchanger, which is used to cool the cabin air, water (from condensed air) is caught with a vinyl sponge. Periodically, the water is squeezed from the sponge into a "condensate" container.

Attitude control can be accomplished by automatic or manual means. Small hydrogen peroxide (H_2O_2) jets provide the corrective thrusts for both systems. Two separate H_2O_2 systems are included, one each for the manual and automatic systems. The autopilot used for automatic stabilization consists of two attitude gyros, three rate gyros, and logic and programming circuits. Erection of the vertical and directional gyros by the horizontal scanners is programmed every ten minutes.

The H_2O_2 thrust chambers are controlled by solenoid valves and, in order to conserve fuel, two different sets of thrust chambers are used. For pitch and yaw, 24lb ("coarse") and one-pound ("fine") thrust chambers are installed, while six-pound and one-pound units are employed in roll. The manual system has another set of thrust chambers which are throttleable to the maximum limits noted above. Each manual chamber can be operated through a solenoid valve or a mechanical valve, depending upon the method by which the pilot is using his control system.

The primary method is a rate command system in which the pilot can, through his right-hand control, command the rate of rotation about any axis. In this system, the solenoid valves provide on-off control. Should an electrical failure occur, however, the pilot can elect to operate the same control system directly through a set of mechanical linkages and mechanical valves, which act proportionally. Analogue studies have shown that control through the mechanical systems will be difficult, particularly during retro-rocket firing when large upsetting moments may occur. As a third alternative, the astronaut may control the automatic control system thrust-chambers through electric switches on his controller.

Communications, Power Supply and Instrumentation. Both UHF and HF frequencies will be used for voice communications. These voice links are operated simultaneously. Two telemetry links, one of higher frequency than the other, are also included in the Mercury vehicle and, as a back-up for the voice communication, the higher telemetry link may be "keyed" by the pilot. Two identical command receivers are carried, both operating on the same frequency. Through these receivers three functions can be commanded from the ground: resetting the retro-timer, firing the retro-rockets, and aborting the mission. The command receivers can also receive voice communication.

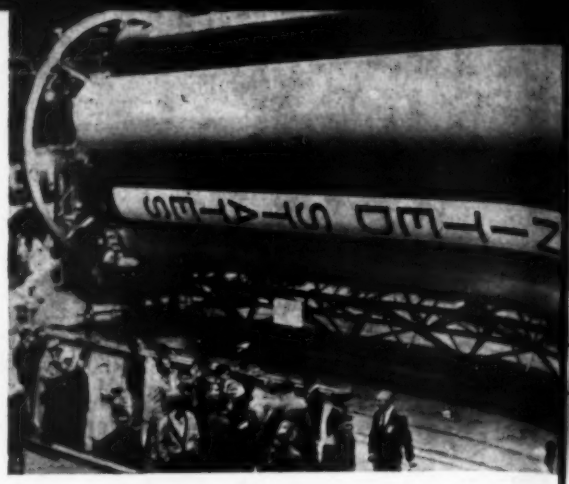
The Mercury capsule uses three batteries as a power source. These are the main, auxiliary and standby units. AC is produced by solid state inverters.

The instrumentation system includes provision for both telemetering and on-board tape storage of all data. Monitoring of the satellite clock which fires the retro-rockets is a particularly critical piece of information which must be telemetered to the range stations. Two 16mm cameras are installed to photograph the pilot and instrument panel, while a 70mm camera is used to photograph the horizon through one of the windows of the capsule. Cosmic-ray emulsion packages, located near the pilot's head, will record the intensity and direction of cosmic rays encountered during the flight.

Operational Sequence. The Mercury capsule will be delivered to Cape Canaveral after a flight acceptance inspection at the plant of McDonnell Aircraft Corp, builders of the vehicle. The Atlas booster will undergo a similar inspection before delivery to the test site. Mating of the two will take place on the launching pad, and a full static firing will take place before a manned flight is attempted.

The astronaut will board the Mercury vehicle approximately one hour before a live launch. Present plans call for him to board from the gantry crane; one of the familiar "cherry pickers" (portable fast-acting towers) is being procured, however, since it may not be practicable to allow the gantry to remain in close proximity to the missile during the required period. In any event, the cherry picker will stand by to assist in rapid egress from the capsule should

(*Concluded on page 202*)



During an exhibition to mark the fourth anniversary of the US Army Ballistic Missile Agency, visitors saw for the first time the first stage of Saturn. Powered by eight Rocketdyne H-1 engines, this stage is due to reach its full 1,500,000lb thrust next month, on a huge static rig outside. The engines are at present being installed

Missiles and Spaceflight . . .

LADY FROM MOSCOW

Within the first few days of her visit to Britain, Mrs Alla Masevich, professor of astrophysics at Moscow University and vice-president of the astronautical council of the Soviet Academy of Science, endeared herself to Press and public by her charm, sense of humour and scientific enthusiasm. Little in the way of brand-new information came out of her Press conference on February 5 or her Festival Hall lecture on *The Conquest of Space* on February 6, but it was apparent that the Soviet Union could have chosen no better ambassador to talk (in excellent English) about Russian space achievements.

Prof Masevich emphasized that the USSR did not intend to send men into space until "the only practical problem"—that of safe re-entry through the atmosphere—had been solved. Over 15,000 volunteers from many countries (including Britain) had written asking for a place in the first Soviet space vehicle; these included doctors, engineers, scientists, students and priests. The professor declined to forecast the type of mission which the first Russian manned spacecraft would carry out, apart from stating her personal hope as an astronomer for a manned Earth satellite carrying an optical telescope.

Asked about the number of launch failures preceding the successful Russian satellite and probe firings, Mrs Masevich said she did not know of any such failure—each time her tracking network had been alerted there had been something to observe. The best re-entry performance to date was the recovery of rocket-carried dogs from a height of 450km. The Festival Hall lecture was accompanied by a colour film of Soviet IGY activity made by the Moscow Popular Science Film Studio.

QUO VADIS?

In the London *Daily Mail* of February 4, Stevenson Pugh, the paper's defence correspondent, suggests that "it has now been accepted by the Cabinet, the Chiefs of Staff and their advisers that Blue Streak is never likely to become fully operational." He suggests that "Once the Russians could guarantee the accuracy of their rockets within half a mile, Blue Streak would be as vulnerable as today's Thors which stand plain for all to see fixed on their surface-launching pads in East Anglia." In fact, he avers that Blue Streak as an inventory weapon is not worth the money, and that the programme is being "slowed up."

Later, the Minister of Aviation, Duncan Sandys, said, "I know of no intention to discontinue the development of Blue Streak"; but the shortcomings of any fixed ballistic-missile emplacement need no underlining. Already the Atlas ICBM system of the US Air Force has progressed through three distinct stages of hardness (immunity to nuclear attack), and the rather later Titan system has been 100-per-cent underground from the outset. Nevertheless it is now accepted by the US Defense Department that there will be no further procurement of any deterrent that has to stay in the same place until it is used. Today a fixed location inevitably means dire vulnerability, even at a range of thousands of miles.

At present, fully controllable hypersonic vehicles and space weapons are still only paper projects. It is therefore generally conceded that the ultimate delivery of any nuclear warhead must be accomplished either by a fully controllable winged vehicle, capable of approaching its target from any direction, at any altitude, and of taking evasive action, or else by a hypersonic ballistic device. Whichever method is adopted the vehicle is vulnerable if fired from a fixed site, and one can suggest three alternatives.

1 It may be mounted—and launched from—a land vehicle. Even if the latter is constrained to follow a major highway, railway or canal, the resultant independence of any particular geographical location provides adequate protection. Principal drawbacks are the vulnerability of the system to sabotage (one need only remove the contact arm from a truck magneto, bore a hole in the barge or damage the railway track to return the concept to that of a fixed emplacement) and its immense logistic difficulty—even in such simple matters as keeping the launch crews supplied with pay, food or amusements, and in maintaining discipline and protecting them from assassination. An example of such a concept is the SM-80 Minuteman of the US Air Force.

2 The missile may be launched from a manned aircraft. It should be emphasized that, whereas in previous years the burden of effecting penetration rested with the manned bomber, to which such missiles as Blue Steel or Hound Dog are merely adjuncts, the requirement now is simply to lift the missile into the air so that a potential enemy can never say "it is at point X." The most sensible arrangement still places on the parent aircraft the onus for flying the greater part of the mission, so that the ballistic final stage may be relatively small. Rough calculations suggest that an ALBM (air-launched ballistic missile) with a warhead yielding several megatons and having a range of 1,000 miles might weigh no more than 20,000lb. An example of such a system is the GAM-87A Skybolt of the US Air Force.

3 The ballistic final vehicle may be sent to sea, and the obvious vessel to carry it is a nuclear submarine. One may choose to have a minimum-size vessel with a submerged displacement of less than 1,000 tons and carrying a single round, or one may prefer a submersible cruiser of some 6,000 tons carrying 16 rounds. Here again most of the responsibility rests with the parent carrier vehicle, the ballistic final stage having a range of little more than 1,000 miles (few points on Earth are more than 1,500 miles from navigable waters). The outstanding example of this system, in big-ship form, is the Fleet Ballistic Missile System of the US Navy.

All these systems are immensely costly. In view of the fact that America is well advanced with an example of each it would not be surprising if Britain were to buy one or more as a going concern. This would certainly cost much less than if we were to "go it alone." But whatever happens, we shall keep Blue Streak.

W.T.G.

DISCOVERER FAILS

The ninth in the series of USAF Discoverer satellites was launched from Vandenberg on February 4, but radio contact with the satellite was lost and it was believed that orbit was not achieved. A 300lb re-entry capsule was scheduled to be ejected on the 17th orbit, and mid-air recovery was again to have been attempted.

POLARIS IN PRODUCTION

Lockheed's Missiles & Space Division and the US Navy appear to have won their fight against time in the amazingly compressed Polaris development programme. The first operational Polaris, with a range of 1,200 miles, is now going into full production, and USS *George Washington* is scheduled to work up to operational status before the end of this year. She will have two crews—respectively designated "blue" and "gold"—only one of which will be on duty at any given moment. Like her sister ships, she will carry 16 rounds. Nine Polaris-type submarines are to be commissioned before the end of 1962, and Admiral Arleigh Burke has testified that the number may run as high as 45.

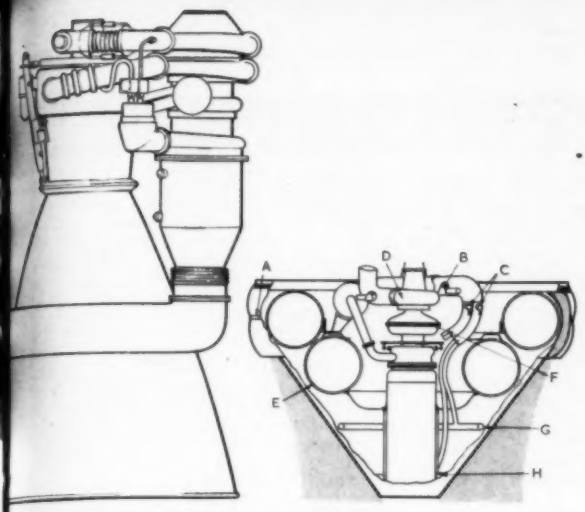
LACROSSE FIRINGS

Cold-weather trials of the Martin (Orlando) Lacrosse are being carried out by a joint US/Canadian team at Fort Churchill, Manitoba. Four battalions of the US Army are in training with the weapon and the remaining four are currently being equipped; future production for the US Army will be confined to replenishment and spares, Deliveries to the Canadian Army have yet to begin. The first US Army Lacrosse unit—5th Missile Battalion, 41st Artillery—fired a Lacrosse on the range at McGregor, New Mexico, on January 29. Lacrosse Battalions are undergoing intensive training at Fort Sill, but the range there is inadequate for live firings.

PLUG NOZZLES

During recent years it has become evident that singular advantages can be gained by employing an entirely new type of rocket nozzle, in which the jet issues from an annular orifice surrounding a large central body with a tail tapering in more or less conical form. Variable-geometry nozzles of this type have been used on such turbojets as the Jumo 004 and the early Atars; and one is also a feature of the Pratt & Whitney J52 which powers the NAA Hound Dog air-to-surface missile. The modern plug-nozzle rocket is of greater importance; previously classified in both Britain and America, it has now been described by our transatlantic contemporary *Aviation Week*, although the British work still remains safeguarded by security.

The sketches (top of p. 201) indicate the compact configuration of a large plug-type engine. The propulsive jet (shaded) is expanded not inside a divergent duct, but by being ejected alongside the conical plug. The process is akin to reversing the flow around a centrebody (especially Oswatitsch) intake, and may be considered as a conventional con-di nozzle turned inside out. It will be appreciated that downstream of the annular nozzle the jet



Relative sizes of conventional engines (Rocketdyne F-1, 1.5m lb thrust, left) and a plug design of the same thrust; A, restraining band; B, main fuel valve; C, fuel vector valves; D, oxidant pump; E, auxiliary fluid tanks; F, gearbox; G, upper coolant manifold; H, lower coolant manifold; the propulsive jet is shown shaded

Missiles and Spaceflight . . .

is controlled by the ambient pressure and by the position and contour of the plug. Since the atmosphere forms the outer boundary of the jet it follows that, as such an engine climbs through the atmosphere and into space, the expanding flow adjusts itself automatically by spreading out further and further from the plug. This is something that a fixed-geometry "internal" nozzle cannot do. At, or above, the design pressure ratio (or altitude) the plug engine is certainly not inferior in performance to the conventional design, and at all lower pressure ratios it is superior. This renders the plug concept particularly applicable to large booster engines, which operate in the lower reaches of the atmosphere.

A further advantage of the plug engine is that the plug may be sectioned by radial cuts and treated essentially two-dimensionally. This means that a segment, perhaps only 20° in "azimuth," may be rig-tested in the same manner as a single gas-turbine combustion can during the development of an entire chamber. Moreover, such segments may be cut in or out of circuit as if they were separate engines in order to provide asymmetric thrust and vector control, without having to mount the entire powerplant on gimbals.

In conclusion, it may be repeated that the plug-type engine is singularly compact, and a further advantage is that its internal volume may be put to good use (see sketch). It is also certain that, as a plug-powered vehicle will not have a blunt base, flow problems in this area should be eased. A case in point concerns the giant first-stage booster of Saturn in which eight conventional engines are used, creating severe mechanical and aerodynamic problems. It seems fairly evident that any future booster of this calibre will be of the plug type.

BRITAIN'S FIRST SATELLITE

DETAILS of the experiments to be carried in the first joint Anglo-American satellite, which has been named International 1, were given at a Press conference at the Royal Society on February 2 by Prof H. S. W. Massey, chairman of the British National Committee on Space Research. Less specific but significant hints were also dropped on this occasion concerning more-ambitious British satellites for the future, which could be launched by a Blue Streak/Black Knight combination.

The National Committee on Space Research is a scientific committee of the Royal Society and a member group of COSPAR, and Prof Massey made it clear that his committee's work was concerned solely with the scientific objectives and equipment to be carried in satellites, and not with the question of launching vehicles. The present arrangements are the result of an offer made to other countries at the March 1959 meeting of COSPAR by the US delegate, Dr R. Porter, on behalf of the US National Academy of Sciences. In June a group of British scientists visited Washington and a firm agreement was made with NASA for the provision and launching of US satellite vehicles which would contain British scientific instruments.

Proposals for these experiments were agreed by the British National Committee in December last and were subsequently approved by the Government's Steering Group on Space Research. On January 20 this year, Prof Massey, Dr A. P. Willmore and Dr H. Elliot met with NASA representatives in Washington "to discuss the desirability and feasibility of the experiments, and to set up the appropriate organization for carrying out the task of providing the fully instrumented satellite package." Agreement was reached on the suitability of the experiments, and on the constitution of the working group responsible for the design, construction and testing of the satellite package.

The UK manager for the project will be M. O. Robins, a senior principal scientific officer of the Ministry of Aviation, who has been seconded to the Royal Society for work with Prof Massey. Target date for launching (by four-stage Scout booster) the first joint satellite, is "the latter part of 1961."

The experiments chosen for the first joint satellite are:—

1. Ion and electron studies by probes (Dr R. L. F. Boyd, Department of Physics, University College, London). The principles of the Langmuir probe are used to determine three quantities of fundamental importance:—

(a) Electron temperature

(b) Electron concentration

(c) Ion mass spectrum.

2. Electron density experiments (Prof J. Sales, Department of Electron Physics, University of Birmingham). Measurement of the RF complex conductivity between two electrodes mounted on the satellite is used to explore the local spacial electron density.

3. Solar radiation studies (Dr R. L. F. Boyd, Department of Physics, University College, London). Three Lyman-α ionisation chambers and two X-ray counters are used to study the solar ultra-violet and X-ray spectrum, primarily to correlate solar behaviour with the ionospheric measurements.

4. Cosmic ray experiment (Dr H. Elliot, Department of Physics, Imperial College, London). A Cerenkov detector is used to measure the intensity of heavy nucleii as a function of latitude, and so determine the primary cosmic ray energy spectrum and the change caused by modulation of the interplanetary magnetic field.

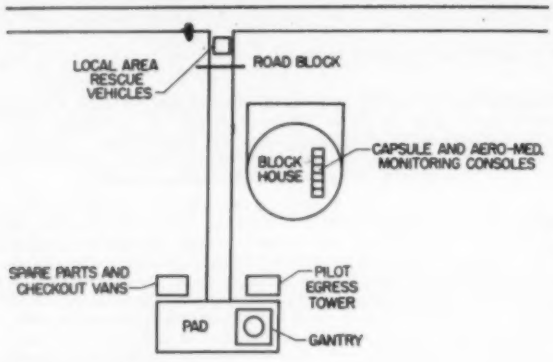
Prof Massey stated at the Press conference that the satellite would be launched into an orbit with perigee and apogee of approximately 200 and 600 miles, at an inclination (about 56°) which would take it over Edinburgh on its northernmost passes over this country. The total payload, including data-transmission equipment, would be 150lb. The satellite casing, and the temperature-control and data-transmission equipment carried in it, would be supplied by the USA.

For tracking and telemetry reception an international network of ground stations would be employed, including a number of stations in the United Kingdom. The recently agreed international radio frequency for space research would "almost certainly" be used, and the lifetime of the satellite was expected to be not less than 6 months. The decision whether to carry solar batteries had not yet been made.

The number of joint US-UK satellites at present planned was three, all of which would be launched from the USA. The first would be launched from Wallops Island, Virginia. The selected instruments would have to complete a triple test programme before firing: (1) they must be shown to work in sounding-rocket firings; (2) they would have to undergo testing at the Royal Aircraft Establishment; and (3) they would be subjected in the USA to the normal procedure for pre-firing testing of satellite equipment. For the second satellite in the series radio-astronomical and meteorological observations were planned, but details of these had not yet been agreed.

The "watching brief on space research" kept by the Ministry of Aviation was described as "a modest effort" by Dr Lighthill, director of RAE, but it became obvious at the conference that the Ministry's design studies into the possible applications of Blue Streak plus Black Knight (plus a possible third stage) as satellite launchers were thorough, far-reaching and had produced favourable answers so far. One idea which was being examined as a possible successor to the Scout-launched "Internationals" was for a stabilized satellite on which a telescope could be mounted. This would certainly need something more powerful than a Scout booster.

Dr Lighthill indicated that the British satellite-launcher design studies were continuing and would carry on for at least another year. "The information to date is favourable on the project," he commented. Just how favourable may perhaps be gauged by recalling that the original announcement of the design studies, on May 12, 1959, was accompanied by the statement that they should be complete in six months' time.



Layout of Project Mercury launch complex at Cape Canaveral

PROJECT MERCURY . . .

(continued from page 199)

an emergency arise on the pad before the pilot is in a position to employ the capsule escape system.

Should an emergency occur during the final stages of countdown, the pilot can effect his escape by firing the capsule's escape rocket which is mounted on the tripod. This rocket provides a large total impulse which separates the capsule from the Atlas and lifts the vehicle rapidly to a safe altitude where the recovery parachute can be deployed. Even during boosted flight through the atmosphere, the escape rockets have sufficient power to separate the capsule from the booster and permit parachute recovery. Escape can be initiated by the pilot, by ground control, or by the booster's self-contained "abort-sensing" system.

Once the ready light comes on in the blockhouse all is in readiness. The mission is initiated by a firing signal from the blockhouse. But thereafter, a sequencer in the capsule controls all flight events. Shortly after release of the Atlas boosters, the escape tower (holding the escape rockets) is jettisoned (its high impulse not being required for acceleration to orbital velocity). When orbital velocity is attained, the Atlas sustainer engine cuts off and the "posigrade" capsule motors are fired to effect capsule separation from the Atlas. These motors provide a velocity increment of 20 ft/sec.

The capsule will be launched out over the Atlantic in the general direction of Bermuda. This direction of launch not only utilizes the performance gains associated with the Earth's rotation, but allows the capsule to pass over the USA on each of its first three orbits. A landing is planned after the third orbit, and initiation of re-entry will begin as the vehicle is within range of and is being monitored by the Pacific Missile Range. Should the automatic sequencing system fail, the range can command re-entry.

Monitoring and control of the operation while the vehicle is in orbit will be accomplished through the use of 17 stations located throughout the world. The distribution of these stations has been arranged so that at least one of them is in continuous contact with the vehicle from initiation of the launch until 15min after insertion into orbit. Continuous contact is also possible throughout the normal re-entry manœuvre and throughout most emergency re-entries, including those at the end of the first and second orbits. Over the remainder of the orbital path the spacing of stations is such that no major event (i.e., re-entry) could occur without knowledge of one of the ground stations. The exception to this statement applies to portions of the third orbit, where the spacing is wider; it is suggested, however, that if the mission has progressed into the third orbit without mishap, there is then little likelihood of an untoward event occurring.

With the exception of two ground stations in the USA, all Mercury stations will have available two-way voice communications and provision for receiving telemetry data. Radar tracking will also be provided at those stations concerned with launching/re-entry operations and in Hawaii and Australia, these sites being well-suited for use in establishing the Mercury vehicle's precise orbit. Command facilities will be located at those stations where required.

All stations will be connected by ground communication with the Mercury Control Center at Cape Canaveral. Both voice and teletype communications are provided in most cases. After passage of the capsule over each station, a summary message will be transmitted to the Control Center. Tracking information, for refinement of the orbital ephemeris, will be sent to the Computing Center in Washington.

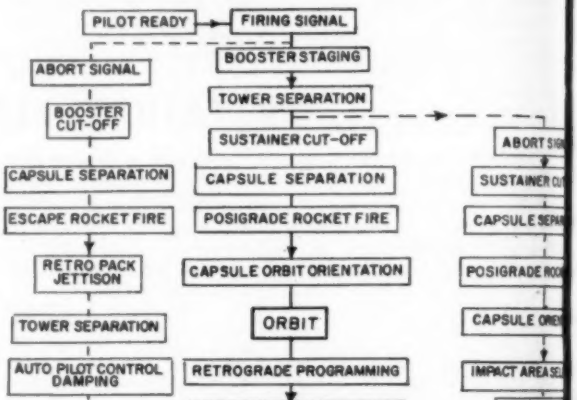
Hub of the operational activities is the Control Center at Canaveral. It is planned that this unit will assume responsibility (taking over from the blockhouse) immediately after launch.

Re-entry and Recovery. Immediately after insertion into orbit the capsule is rotated (from its launch position of heat shield aft) 180° in yaw, and is pitched-up 34° into the retro-rocket firing attitude. This position is maintained for five minutes so that the capsule can immediately re-enter the atmosphere if it is determined that the vehicle is not in a suitable orbit. When it is known that a satisfactory orbit has indeed been realized, the capsule is pitched down to its orbital attitude of 14° nose-up. In that position the periscope is normal to the Earth and the pilot is sitting upright, facing aft.

Re-entry under normal conditions will occur after the retrograde motors are fired in sequence. These provide a decelerative velocity increment of 500ft/sec and are used to bring the capsule out of orbit. Firing of the retrograde motors is interlocked with an attitude gate of ±16° from the desired re-entry angle. This is done so that if the capsule drifts to an incorrect re-entry attitude, the retro-rocket impulse is terminated until the attitude is corrected, thus conserving retrograde impulse.

At 10,000ft altitude the canister (or antenna section) on the afterbody is jettisoned and the 63ft diameter ring-sail parachute is deployed, providing a sea-level rate of descent of 30ft/sec. The reserve parachute is used only if the main parachute fails. After parachute deployment the heat shield is released from the capsule and a rubberized glass-fibre impact bag, located between the shield and capsule, inflates. On impact with the ground or water, the air trapped between the shield and capsule is vented through small holes to provide a cushioning effect.

Recovery is intended to be in the Atlantic Ocean somewhere between Florida and Africa. In the region near the US coast —where the possibility of an abort at launch is present—ship spacing has been planned so that the maximum access time to the downed capsule is three hours. Ship spacing in the calculated



Mission sequence for Atlas-boosted orbital Mercury flight

impact area in the case of the Atlas sustainer failing will enable the capsule to be reached in a maximum of six hours. A three-hour access time is planned for routine operations after re-entry on the third orbit. The primary search method will involve long-range aircraft employing active electronics search, using Sarah-type equipment [Sarah is made in Britain by Ultra.—Ed.]; a number of other electronic, visual and audio-location aids are included in the capsule system, however, to aid the recovery forces.

After recovery, should all go well, the astronaut will soon be speeded back to the USA for what will probably be a spontaneous public demonstration the like of which is beyond the scope of anyone's imagination.

Such is the programme envisaged for Project Mercury.

The comprehensive and, indeed, magnificent effort of this man-in-space project can best be appreciated when one considers the development cycle ordinarily associated with modern, high-performance vehicles. Few contemporary supersonic aircraft have reached the flight-test stage sooner than four or five years after the initial conception of the programme. The F-108 (had it not been cancelled) and the X-15 had schedules requiring at least that period of development. Yet it seems as if barely a few months have elapsed since the initial serious discussions were held in the USA with a view towards placing a man in orbit—a project considerably more ambitious than the construction of any atmospheric vehicle. Exactly *when* will the Mercury vehicle be hurled into orbit? No one has yet given a precise target date, but it very probably will be within the next 18 months. DON ADAMS

Seen at a recent finance meeting, reference to which is made in this article, is BOAC's board of executive management. From left to right: Dr K. G. Bergin, director of personnel and medical services; Capt T. H. Farnsworth, chief of flight operations; C. Abell, chief engineer; K. W. Bevan, financial comptroller; K. G. Granville, deputy managing director; J. B. Scott, chief economics adviser (standing; deputizing for Winston Bray, central planning manager); Basil Smallpeice, managing director; K. H. Staple, secretary and legal adviser; Gilbert Lee, commercial director; J. R. Stainton, general manager western routes; D. H. Glover, general manager southern routes; B. W. Bampfylde, general manager eastern routes. The chief press and information officer, F. C. Gillman, who is a member of the executive management, was absent abroad when this picture was taken

BOAC Takes Care of the £s

THE CORPORATION'S METHOD OF HOUSEKEEPING

By J. M. RAMSDEN

NOT so long ago *Flight's* columnist Roger Bacon drew attention to a report on the cost structure of the Indian Airlines Corporation. A good deal of public money had been poured into IAC without return, and an inquiry into its efficiency had been carried out. Some points from the report about airline budgetary control were so full of sound sense that Straight and Level published extracts.

These prompted from BOAC an invitation to *Flight* to study the corporation's own system of budgetary control, which it regards with some pride. BOAC cannot yet be classed among the most efficient of airlines (though if present trends continue it may well be in future years). But this does not necessarily mean that its system of planning and controlling its budget is not among the world's best.

It is hard to pinpoint a precise definition of efficiency: many indices may be used, including output per employee, cost per capacity ton-mile produced, return on capital, and so on. None of these is a perfect index when taken out of context. But each must be "optimized," and this cannot be done without vigilant budgetary control.

Responsible for BOAC's financial discipline is K. W. Bevan, financial comptroller. One of his first decisions when he joined the corporation about seven years ago was that every department in the corporation should have its own accountant. In general, the men chosen were experienced chartered accountants first and foremost, though in some cases—as will be seen in a moment—they were also experts in their department's particular field of activity. It was to be the responsibility of each department to account for every item of expenditure, and to avoid the tendency, inevitable in any organization, for departments being charged with another's expenses and *vice versa*.

There are, of course, many marginal responsibilities—for example, charges for buildings and property. Some departments require a great deal more floor space than their work force might, by comparison with other departments, justify; and equitable proportionment of costs on a square footage basis is not always possible. A further comment on this is made later.

So Mr Bevan's first step was to ensure that every department had the right expenditure charged to it. The next step, and we are talking now of the year 1951-52, was to call upon each departmental manager after the first few months of experience to come forward with an estimate of the amount he expected to spend in the next year. This estimate of course required an overall production programme, broken down route by route, with c.t-m. and hours included. Such a programme, now a routine part of the system, is initiated by the sales department which, on the basis of local estimates from overseas stations, estimates what sort of capacity the corporation can expect to fill. This is followed by an assessment from the operations department of how much of the estimated required capacity it can expect to provide. The economics branch then makes a pilot cost estimate based on this overall plan—"this route will cost so much, that route so much," and so forth. This leads to the manpower budget: the wage bill is the biggest single item of airline expenditure (30 per cent in the case of BOAC's costs in 1958-59). Every department has to decide at this stage what will be required during the next year in the way of staff to fulfil the requirements of the operating plan. This is not always so easy. For example, one year the personnel manager went on record as saying: "If I have to take on *that* many engineers to fulfil this operating plan, I shall need a whole building full of people interviewing people."

The manpower budget determines the wage bill. The next biggest item of expenditure, fuel, is being simultaneously estimated by the flight operations people. This department has the advantage of having as its accountant Capt Maurice Aries, a former Comet Flight skipper, who is also a chartered accountant. Naturally, only an experienced skipper knows all the wrinkles on ways in which fuel can be saved. In working out fuel costs it is of course not sufficient to determine, from the operating plan, the fuel consumed between point A and point B on the basis of aircraft flight planning tables. The questions that must be asked are, for example: "Are the existing flight planning techniques too extravagant?" Only a practising captain has the judgment to decide this. Again, "How much can be saved by flight planning so as to take advantage of the different fuel uplift costs at various stations?" This can be a very important consideration: literally thousands of pounds a year can be saved by topping up tanks to the limits regardless of sector length at stations where fuel costs are lower. This calls for an awareness of such opportunities to be instilled in all flight crews—and this is something which *Flight* has experienced at first hand in the course of proving and training flights with the corporation's crews.

So far as flight planning techniques are concerned, it has been estimated that a saving of a quarter of a gallon an hour can save the corporation £10,000 a year. Again, awareness among skippers of the optimum fuel-saving techniques is an important objective for the flight operations department.

In general, taking expenditure as a whole, variances from budget emerge at the end of each of the corporation's 13 four-weekly accounting periods. These variances appear as red figures, which are pounced upon at each four-weekly management budget meeting. The principle of the system is such that the reason for the variance can be traced right down, level by level, to the humblest origin. Should one particular item of expenditure be £10,000 in the red, it is possible immediately to track it right down to its source. Of course, it has to be ascertained that the budget has not been too pessimistic—i.e., that a lot of healthy looking black figures are only black because too much expenditure was allowed in the budget in the first place. It is possible that managers who see that they are getting along well within their budget may decide to be rather extravagant, and buy, for instance, those long needed new filing cabinets. But the safeguard here is that all the individual budgets appear before the management in the form of one budget, enabling management to decide whether *overall* the result is a reasonable return on resources.

Mr Bevan reckons that if, in the light of a few years' experience

BOAC Takes Care of the £s . .

of their system, the expenditure works out within one per cent of budget, the situation can be regarded as reasonably satisfactory. This year (1959-60), for example, at the end of the seventh accounting period, the corporation's budget was £152,000 on the right side on a total expenditure of about £60m—a variance of about one-quarter of one per cent. This takes into account an adverse variance in the budget of the chief engineer, whose department was in the red, principally due to an epidemic of engine failures. Such an unexpected incidence of costs obviously has a serious effect on the engineering budget. Even without a system of budgetary control a sudden big leap in costs could be traced to such an obvious cause. But budgetary control does enable its precise effect to be measured, and adjustments can be made to the planned expenditure of that department in the accounting periods ahead.

Here it is interesting to consider the BOAC engineering department's budget for engine overhaul costs. Supposing that an engine's approved ARB overhaul life is 1,100hr, the department knows that in actual practice it can expect to achieve rather less —say 1,000hr. Supposing also that the standard cost of overhaul is £1,000—i.e., £1 per hour per engine—this rate of charge is booked in each engine's log-book. Thus, if an engine fails prematurely and only £800 has been booked, the cost of that failure is £200. On the other side of the account, if the engine achieves its 1,100hr there is a gain of £100, which goes into the reserve. Thus the cost of a sudden spate of failures will be revealed as soon as it occurs and will not have to wait to be revealed until the expensive engine overhaul programme has been completed some weeks later.

Wages, fuel and overhauls comprise the major part of an airline's expenditure—55 per cent in the case of BOAC last year. But to be controlled no less carefully are spares. Huge stocks of these have to be written off over the life of the aircraft concerned, and obsolescence costs are far greater than consumption costs. Thus the work involved in booking consumption costs can be unnecessarily laborious: the advantages of trying to control spares consumption, which is a purely technical matter (what accountant can say that a microswitch or new brakes should not have been fitted in a particular case?) is much less important than controlling the investment in the stock and its obsolescence. The size of the stock is, of course, determined from past experience of spare-parts consumption.

Allowance has to be made in any system of budgetary control for changing circumstances. It is for this reason that a distinction has to be made between fixed and variable expenditure. Variable expenditure is defined by Mr Bevan as "what it does not cost if it does not fly." Fuel and oil are, of course, good examples of variable costs. Other items are not quite so easily distinguished. BOAC regard crew costs as fixed, even though when services are for any reason discontinued, crew expenses (variable) are not incurred. The criterion here is that crews cannot be laid off by BOAC, as they might be laid off by other airlines. Examples of fixed costs are obsolescence, insurance, wages, premises, etc.

Having distinguished between fixed and variable costs it then becomes possible to work out the cost of every single flight. BOAC calculates a standard cost of operating every service, this cost being split between variable and fixed costs. Having established such standard costs, the planned number of round trips multiplied by the appropriate standard costs should equal the budget. If a service is cancelled adjustment is made to allow for a distinction between fixed and variable costs, and the departments are let off their variable costs. Whenever Press reports refer to a BOAC spokesman's estimate of how much a cancelled service has cost (e.g., the suspended trans-Pacific service early in 1959), it is usually the fixed cost which is being quoted. If the cost was greater than the revenue, it would be the lost revenue that would be quoted.

So much for the costing side of the equation. It is then necessary to produce, route by route, the overall result with revenues taken into account. Every month each of BOAC's three route managers (eastern, western and southern) receives a statement showing actual adjusted costs incurred on his routes and the actual achieved revenues. Top management is presented each month with the *overall* cost-revenue picture made up of these three separate statements (which are, however, attached for top management reference so that details can be gone into). This system makes it possible for each route manager to pinpoint and account for every variance in his particular route system. He knows that he will be called to account at these meetings for any such variances.

Every quarter top management receives a cumulative statement. This makes possible the discernment of broader trends, and the correction of malignant trends before they become too serious. Forgetting for a moment its purpose as a financial "howgozit," it is difficult not to admire this quarterly cumulative statement as a work of art. All "budget" figures are typed in green, and "actual" results appear in black or red. The layout of the statement is designed so that the multiplicity of figures involved are arranged in such a way that the trained eye can grasp the situation, detail by detail, almost at a glance.

An interesting point to be noted is that for route comparisons mail is evaluated at freight rates so as not to distort the true picture of the economics of each route. Some routes are rich in mail while others are not so well larded with this valuable commodity. There is also the point that the amount of mail picked up depends to a large extent on chance and time.

The budgeting of revenues is a much less exact science than the budgeting of costs. But BOAC's accounting people say they have "got it down to a fine art." The first step is for each station to report on the potential market in its sphere of influence and to estimate its sales and revenue targets for the year ahead. As with costs, achieved *versus* budget figures are compared and accounted for. But as Mr Bevan points out, it is not the actual amounts involved that are so important. It is the extent to which they err on the wrong side of the line, and the reasons for the variances, which are the essence of sound budgetary control.

BLACKBURN FUTURE

IN his first public speech as chairman of the Blackburn Group, Arthur Jopling said at the recent Brough apprentices prize-giving in Hull: "We are convinced that the future of the company will be enhanced by our becoming an integral part of the very strong group which is now being formed. Our gathering next year will still be under the name of Blackburn and there is no intention of disturbing the existing organization."

Mr Jopling presented the Robert Blackburn Memorial Prizes, and the merit awards were presented by W. J. Carron, president of the Amalgamated Engineering Union. The directors' prize—a wristlet watch, which had been awarded to Peter Brattan as the best all-round craft apprentice—was presented by T. Bancroft, the works director.

A. C. HARTLEY

WE record with regret that Arthur Clifford Hartley, CBE, president of the Institution of Civil Engineering since last November and responsible largely for the Pluto undersea oil pipeline and—in the same year of the Second World War, 1942 —for the Fido fog dispersal system for airfields, died in a London hospital on January 28 at the age of 71.

During the First World War he was a pilot in the RFC and the RAF, and also played a part in developing the Constantinesco synchronizing system for gun-firing mechanism. In the Second World War he was lent by his company—the Anglo-Iranian—in 1940 for work on the development of a stabilized automatic bombsight. His work on Fido was carried out in 1942 when he was made Technical Director to the Petroleum Warfare Department. He was appointed CBE in 1944, and awarded the US medal of Freedom for his work on Fido.

HIGH-SPEED CINEMATOGRAPHY

FOR many years past the firm of John Hadland & Co, of Chipperfield, Herts (King's Langley 3669), has operated a high-speed cinematograph service, available to industry on a daily contract basis. During this period, they state, they have exposed well over a million feet of film and in the process have accumulated a great deal of experience, as a result of which they have been appointed agents for the leading manufacturers of equipment used in this field. They are able to give advice on apparatus and techniques required to those about to employ high-speed cinematography for the first time. Widely used in aircraft and engine research work, the process is, of course, a well-established one—the analysis of high-speed motion by means of a slow-motion film. The film is exposed at many times faster than normal speed but is projected at normal speed. The mechanism of an orthodox film camera limits film speed to about 200 frames per second, because of the limits imposed by the physical strength of the film; in high-speed cameras the film moves through the gate at a continuous speed and the image from the lens is passed through a rotating prism. Cameras of the prismatic type can cover a range of from 160 to 16,000 frames/sec, and with projection at the normal speed of 16 frames/sec any degree of slow motion from ×10 to ×1,000 can be obtained.

Cameras are available through John Hadland & Co for 8mm, 16mm and 35mm film sizes; some types have a second optical channel so that a simultaneous film record can be made from an oscilloscope. Normal projectors are usually employed, but the use of an analysis projector, giving facilities for still pictures or frame-by-frame progression, simplifies the process of analysis.

For customers whose work does not justify the purchase of equipment the company continue to operate their contract service.

THE BRITISH & COLONIAL AEROPLANE COMPANY, LTD.

TELEGRAMS:- "AVIATION, BRISTOL." CODES:- A.I.A.B.C. & MOREING.

ZODIAC TRADE MARK

TELEPHONES:- HEAD OFFICES:- No 2 P.O. 74 & 3074 NATIONAL. WORKS:- 4 FILTON NATIONAL.

DIRECTORS:
SIR GEORGE WHITE, BART.
SAMUEL WHITE.
G. STANLEY WHITE

SECRETARY, H. WHITE SMITH

MANAGER, SYDNEY E. SMITH.

BANKERS, BANK OF ENGLAND.

HEAD OFFICES:-
CLARE STREET HOUSE,
BRISTOL, ENG.

June 7th. 1910.

FIFTY BRISTOL YEARS

The Bristol Aeroplane Company's Golden Jubilee

By G. WANSBROUGH-WHITE, ARAeS

DRAWINGS BY DAVID HARPER

"For it is not names which give confidence in things, but things which give confidence in names."—Chrysostom.

IN 1881 was published a portrait (right) and, with it, these words: "There are, perhaps, few men in the country who have played so important a part in securing for our towns and cities the immense boon of Tramway riding, as the subject of our portrait, Mr. GEORGE WHITE, the indefatigable secretary of the Bristol and Bath Tramway Companies. A man who, at the age of 27, is a prominent member of the Bristol Stock Exchange . . . whose advice and aid have been sought by nearly every town in the West and Midlands where trams have been projected during the past seven years; who is as much at home among the Private Bill Committee Rooms of Westminster as he is in a Director's meeting —is no ordinary man."

The "standard" and most frequently published portrait of Sir George White was at about the time of his death in 1916. On this occasion, and with this brief history, it seems appropriate to portray the young man who was later to found so great an enterprise. For it was the man who became the thing and who added to the fame of Bristol. "Shipshape and Bristol fashion" —it was long a name of reputation and once Second City of the Kingdom, and Bristol is now synonymous with a prestige for famous aircraft and engines.

But something does not start from nothing; and, as the young man matured to his later appearance and stature, so the British and Colonial Aeroplane Company was born of the Bristol and Bath Tramways. On the engine side the story is paralleled with Brazil Straker becoming Cosmos Engineering and merging with Bristol Aeroplane.

It is also the story of a family, and an example of a private family business of comparatively little economic (but early to become of great national) importance which grew into a large public company with international responsibilities. In the years prior to 1910 Sir George, with his brother Samuel White, his nephew (later Sir) William Verdon Smith, and other members of the family, had developed a number of electric tramway systems, started manufacturing and operating motor buses, reorganized the Taff Vale Railway in South Wales, initiated or revitalized a variety of local businesses, and displayed exceptional energy and vision in many other directions.

One of these directions was in taking an immediate interest in the aeroplanes he saw at Pau in 1909. France was at least a year ahead of Britain, and whilst some enthusiastic young men —as pilots, or as manufacturers such as the Short Brothers and Handley Page—had already begun their work, no financier or man of commercial substance and experience had viewed the new dimension with vision; or if they had, none acted so quickly and so decisively.

On February 16, 1910, at a meeting of the Bristol Tramways and Carriage Co Ltd, Sir George announced his intentions:—

"I may tell you that for some time my brother and I have been directing our intention to the subject of aviation, which is one yet hardly ripe for practical initiation by such a Company as the Bristol Tramways and Carriage Co. Ltd., but yet seems to offer promise of development at no distant date; so much so that we have determined personally to take the risk and expense of the endeavour to develop the science from the spectacular and commercial point of view.

"If, as we believe, we can make the headquarters close to Bristol, we shall give our own city a prominent place nationally, and secure for the Tramways Company a very important source of new traffic, as we shall take care that the centre of attraction is located upon the system. And it is obvious that the public interest in the subject will attract enormous crowds from the whole West of England to witness the numerous demonstrations that will take place.

"Incidentally, I may say that we already have on order several aeroplanes of the best designs hitherto produced, with the intention to develop a British industry and make Bristol its headquarters."

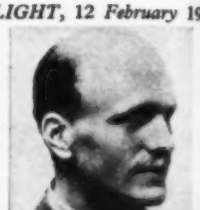
The "centre of attraction" was Filton, beginning with (old) Filton House and some tramway sheds. Old Filton House still stands, joined by the "new" administrative block.

The aeroplanes on order were those of the French Zodiac company, originally (and still) manufacturers of airships, and this explains the "trade-mark" in the original company letter-head. It was quickly followed by a later symbol—the signs of the Zodiac.

Five Zodiacs were to be built, but, as the first proved to be unsatisfactory, the project was abandoned; quite undeterred, Sir George and his co-directors decided, much earlier than anticipated, to take up design and under the hand of Challenger was born the "Boxkite" on the basis of the Farman. The early pilots were also French—Edmond, Tétard, Prier and Jullerot, and this

The British and Colonial Aeroplane Company, Limited.

Sir Henry White-Smith

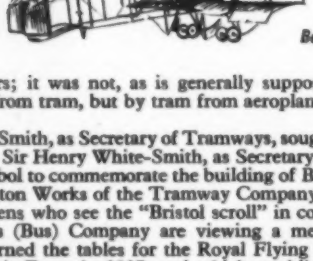


F. S. Barnwell

FIFTY BRISTOL YEARS . . .

connection with France recurs at various intervals in the 50 years. But there were also well-known British pilots, such as Collyns Pizey, Howard Pixton, Warren Merriam and Harry Busteed, now air commodore (retired).

With the break, so the Zodiac trade-mark disappeared, and in late 1910 there appeared the famous Bristol scroll, a symbol known the world over. This was not strictly a trade-mark, as the name of a city cannot so be used; but it is universally recognized as a label of excellence—so much so that it has been used by other manufacturers in Bristol. The same scroll is used on the radiators of Bristol buses and on the uniforms of drivers



Boxkite

and conductors; it was not, as is generally supposed, borrowed by aeroplane from tram, but by tram from aeroplane—and as late as 1920.

Col Sydney Smith, as Secretary of Tramways, sought permission of his brother, Sir Henry White-Smith, as Secretary of Aeroplane, to use the symbol to commemorate the building of Bristol Fighters at the Brislington Works of the Tramway Company during 1916-1919. So citizens who see the "Bristol scroll" in connection with the Tramways (Bus) Company are viewing a memorial to the fighter that turned the tables for the Royal Flying Corps against the German Air Force in 1917, and which established the great name of Bristol aeroplanes.

Apart from the symbol, the company was always jealous of the name Bristol, as instance this letter of Sir Henry White-Smith, secretary, to the Ministry. It is dated April 1918, when the organization was still the British and Colonial Aeroplane Company:—

". . . we would state that whilst being desirous of falling in with your system of indicating machines by the use of a nickname, we must ask you to meet our wishes that all machines of our design are formally described as 'Bristol.'

"We have always used the word 'Bristol' to describe our machines and it has become, in fact, a Trade Mark, and we regard it as being of importance that it should continue to always be associated with our designs."

Sir George was very alive to the value of sound and sustained publicity, and when the company was founded—the exact date was February 19, 1910—an announcement appeared in the very next issue of *Flight*. Until quite recently the back cover of this journal always carried a Bristol advertisement, and the name will still be found in almost every issue.

The young company was an enterprise of experienced and hard-headed businessmen: this was no story of struggling enthusiasts—enthusiasm yes, and much courage, but it was built on sound commercial lines and it began with money. £25,000 is a small capital by today's standards, but it was a substantial sum for those days and certainly an astonishing amount for so crazy an idea as an aircraft industry. It is worth noting the company's growth over the years, as indicated by this table of the issued capital:—

	£		£
1910	25,000	1935	1,200,000
1911	75,000	1936	1,800,000
1912	100,000	1938	3,900,000
1920	553,000	1953	5,880,000
		1954	8,190,000

The works at Filton expanded rapidly, as experimental aircraft came out in quick profusion with the designs of Grandseigne, Graham Gilmour, Challenger, Tétard, Tabuteau, Prier, Gordon-England and Coanda. By 1914 some 200 aircraft had been built, and the Boxkite, in several variants, must have been one of the earliest production efforts on record. Some 70 Boxkites were made, and this was the company's first design.

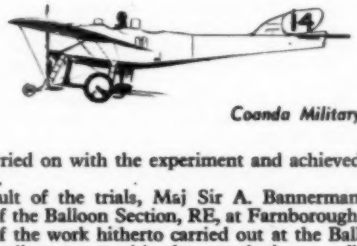
But the directors realized that manufacture was not enough, and that, with so few pilots in the country, they must also engage in training. This they did with such conspicuous success that there were no fewer than 307 "Bristol" pilots in the total of 664 who had qualified for the Royal Aero Club certificate in the four years between August 1910 and September 1914. Of the pilots available for service in 1914, no less than 80 per cent had been trained on Bristol aircraft.

The Bristol Flying Schools at Brooklands and Salisbury Plain were household words in their day, and the tradition of thorough training has continued through the years. (Between the wars Filton was the company centre as a flying school for the Royal Air Force, sharing the aerodrome and air space with No 501 Squadron, AAF, and the company later managed No 2 AONS at Yatesbury.)

Aircraft must not only be built and pilots trained, but the product must be sold. Activity was widespread, and sales areas included Russia, Spain, France, Italy, Turkey, Rumania, Bulgaria. Special missions went to India, Australia, New Zealand and elsewhere. A Bristol was the first aircraft seen in many parts of the world, as often as not the fine old Boxkite. This had the French Gnome engine, and the company later procured the British sales agency, thus further increasing their activities and perhaps showing the first signs of dissatisfaction that they had no engine of their own. In later years they made good the omission to such purpose that Gnome et Le Rhone procured a manufacturing licence from Bristol, to their mutual profit.

Sir George had early realized his ambition—there was indeed an industry, and Bristol was a name in the world. But it was an industry, in spite of the early reluctance of the militarists, that lent itself to war purposes: and Bristol has a military association that has covered the whole of its 50 years. Its existence has been bound up with the early Military Trials, the beginnings of the Central Flying School at Upavon, the Royal Flying Corps and with the Royal and Commonwealth Air Forces in every Command and in every theatre of war the world over. Bristol, too, has formed a part of many foreign air forces, and there can be very few airmen of this half century who have not praised or cursed the name of Bristol—but who will certainly have been very much aware of it. Yet it has not been the whole story, and in present days the "Whispering Giant" has followed on the "Whispering Death."

The first excursion into the military field was from their depot on Salisbury Plain, when in September 1910 it was arranged that Bristol would co-operate. Capt Dickson and Robert Loraine (the London actor and first pilot to cross the Irish Channel) were given a Bristol each, the universal Boxkite. Not only was this the first British military trial, but the first British attempt to transmit wireless messages—to a portable station at Larkhill. Robert



Coanda Military Monoplane

Loraine carried on with the experiment and achieved a range of over a mile.

As a result of the trials, Maj Sir A. Bannerman was given command of the Balloon Section, RE, at Farnborough "to enlarge the scope of the work hitherto carried out at the Balloon School . . . by affording opportunities for aeroplaning. . . ."

And thus the third Service of the British Empire came to life.

A type expressly designed for the later Military Trials of 1912 held on Salisbury Plain was the Coanda Military, which was also significant in being a monoplane. It was, however, involved in a fatal accident, and similar ones had also occurred with Nieuport and Deperdussin monoplanes. The monoplane came under War Office disapproval and the biplane entered its long era of ascendancy. However, Bristol later produced the M.1C monoplane but this, again, was viewed with marked suspicion: it was eminently successful, and a Bristol monoplane received a Certificate of Airworthiness in Australia in 1956—40 years on! In the 1920s came basic research into the cantilever monoplane, the Bagshot, whose lineal descendents were the Bombay and the Freighter. This structural research and persistence can even be traced to the Britannia, and the structural integrity of Bristol aircraft had its origins in research which often did not pay an early dividend. Heavy investment has often been more in search of technical achievement than in immediate commercial promise.

Sir George White stated in 1911 that "There is a great commercial future for the aircraft industry in this country, but everyone entering upon it must be prepared to exercise patience and spend a lot of money in research and improvement. The manufacturer must be prepared to 'scrap' with a light heart, and I fear for a time, a light pocket also. But if 'excellence of production' be the motto, and it is with our Bristol Company, then there is no reason why England should not secure its share of the world's business with aeroplanes."

The monoplane structure was thus an early technical effort, and the Coanda Military, whilst it only won third prize in the British-built section of the 1912 Competition, was a pointer to the future.

Behind these technical experiments and some solid achievements the company was being safely guided to the unsuspected part it was to play in a world conflagration now only two years away. The directorship remained unchanged, a strong family combination of Sir George, his brother Samuel, and his son, G. Stanley White (who was to become Sir Stanley on the death of his father in 1916). Sir Stanley was later to become managing director—in 1919—and is today deputy chairman with an unbroken record with the company of 50 very full years. [*Flight* offers congratulations on an active half-century in one of the most eventful periods in our history.—Ed.]

The secretary was H. White-Smith, nephew of Sir George, and who was later to be knighted for his services to the company and to the country. He became a director in 1919; the creation of

Scout C

the Society of British Aircraft Constructors was much of his doing, and he was to become the first president. One of the early Bristol pilots was a brother of Sir Henry, and was to become a lieutenant-colonel in the RFC—Sydney Ernest Smith, of whom we have already read as secretary of Bristol Tramways in 1921. A third brother, and nephew of Sir George, appears later in our story as Sir William G. Verdon Smith; he became a director of the company in 1927. His son Sir Reginald (who was knighted in his own right) is today chairman of the Bristol Aeroplane Company, and, in keeping with the financial tradition of his great-uncle, is also a director of Lloyds Bank.

Another great name was that of Herbert Thomas—a nephew of Lady (George) White—who was with the company from the beginning. In 1911 and at the age of 18, he was the youngest British pilot to have taken his Royal Aero Club certificate. Soon afterwards he was injured in a propeller accident; and although he made repeated efforts to join the RFC, they were without success. If he could not fly, he would build, and much of Bristol production was due to his efforts. Herbert Thomas became a director, and works manager in 1919: he was chairman of the SBAC in 1933-35, and assistant managing director (under Sir William) from 1931 until 1947.

Our story now introduces—if introduction was ever needed—a name which gave great confidence. He designed and flew many machines, and met his death in 1938 in pursuit of flying. His three sons shortly afterwards gave their lives in the service of the Royal Air Force.

Frank S. Barnwell served his apprenticeship in ship-building in Scotland, and obtained his BSc in Naval Architecture at Glasgow University in 1905. He spent a year in America as a hull draughtsman and then joined his brother Harold in the Grampian Engineering & Motor Co Ltd at Stirling. There the two experimented with gliders and several aeroplanes of varying fate, but with a monoplane won a £50 prize given by the Scottish Aeronautical Society. Harold went to Brooklands to take his ticket on a Bristol in 1912, and subsequently became chief test pilot to Vickers. After a brief spell with Avro, he joined the British and Colonial Aeroplane Company in 1911.

Clifford Tinson joined him as assistant, and their task was to convert a Gordon-England biplane and later to design a monoplane for a Naval aircraft with hydrofoils and a water propeller, to the ideas of Lt C. D. Burney, RN—later, as Sir Dennistoun, much concerned with the airship R.100. The project was financed by the Admiralty and commenced in great secrecy as "X.1" in a cottage in the works. The conversion adventure was not a success.

M.1C

Barnwell came under Coanda, as chief designer, in 1917, but earlier in 1914 had been given a Coanda monoplane with the authority to design a new aeroplane around it. History and achievement was fast in the making, for this was the prototype of the Bristol Scout. The design and stress calculations were done in a penny exercise book, with carbon drawings from a duplicate book sent to the shops. In 1914, flown by Harry Busteed, it reached 97 m.p.h., and two replicas, the Scout B (to be nicknamed the Bullet), were among the first aircraft with the British Expeditionary Force. Can it be only coincidence that the Blenheim was the first British aircraft in action in 1939?

Orders followed for the RFC and (of the Scout C) for the Admiralty, and Barnwell's little "Scout" was one of the first war aeroplanes to be ordered for quantity production. Captain Lanoe Hawker, DSO, RFC, won the Victoria Cross in a Scout, shooting down three enemy aircraft in one day. The Scout D with 80 h.p. Le Rhone and 100 h.p. Mono Gnome did great service in the Middle East. (Shame to relate, the last Scout privately owned and flown ended on a Yorkshire scrap-heap in 1930.)

But, after so splendid a beginning, Barnwell now knew frustration under the Royal Aircraft Factory policy that they should design and the industry should build. Bristol was allocated some production of the B.E.2c, and Barnwell joined the RFC. He won his wings at CFS in early 1915 and was posted to No 12 Squadron.

In this same year there was more dissatisfaction, but on a national scale. The war was going ill for the RFC, who sufferred appalling losses, and the outcry in Parliament led to more effective recognition by the War Office of "non-official" designs. To give credit to the Admiralty and Winston Churchill, they had already advocated this course—and a personal consequence was that the now Capt Barnwell, RFC, was released on "indefinite leave."

Backed by his Service experience, Barnwell and Bristol set themselves the urgent task of producing two new aircraft—a monoplane fighter, clean and fast, and a two-seat biplane for artillery observation and offensive patrol. By late 1916 the first of five prototypes had flown and the M.1A monoplane touched 132 m.p.h. in the hands of F. P. Raynham. The machine was said, officially, to have too high a landing speed, to be dangerous, to have poor downward view—in fact, nothing was right but its high speed and excellent manœuvrability. It was, in fact, just what the RFC wanted, but being a monoplane, only 125 (as the M.1C) were ordered and it was relegated to the Middle East, there to do excellent work. As a post-war sporting aircraft in the hands of C. F. Uwins, Chichester-Smith, Larry Carter and H. Miller the type was later to be justified. One was taken to Australia by Harry Butler, and we have already touched on its extraordinary lease of flying life up to 1956.

Eight Monoplanes were handed over to Chile in 1918 and one of these made the first flight over the Andes.

Fighter

The two-seater begun in July 1916 was flying by September. Barnwell had as his assistant a young graduate from Bristol University, L. G. Frise, who went on an Army course to study the Vickers gun. Official trials were so successful that Field Marshal Sir Douglas Haig ordered two squadrons to be ready for the 1917 Spring Offensive. But if the Bristol Fighter, the F2a, had started with such promise, its debut on the Western Front

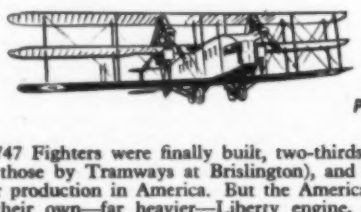
FIFTY BRISTOL YEARS . . .

was disastrous: the first six, under Captain Leefe Robinson, VC, ran into Richtofen and his Albatros circus, and in trying to fight in the conventional way four were lost. Later five ran out of fuel and landed in enemy territory.

But the squadrons learned fast, and all there really was to learn was to fight the machine as a single seater and use the gunner as rear cover. The results were spectacular, and the now F2b —the beloved "Brisfit" or "Biff"—had become one of the classic aeroplanes of all time.

Rolls-Royce also added to their fame, for the Falcon powered the Fighter, and was one of the early birds of prey that were to play so large a part in British aviation history. As the Merlin was to the Spitfire, Hurricane and Lancaster, so the Falcon was to the Bristol Fighter. The Sunbeam Arab and the Wolseley Viper were also used; but of greater significance was a small car factory in Fishponds, Bristol, which was building R-R Falcons and Hawks under licence.

By July 1917 the War Office decided to re-equip all "fighter" and corps reconnaissance squadrons with the Fighter and to produce on a massive scale which was virtually a "shadow" industry. A



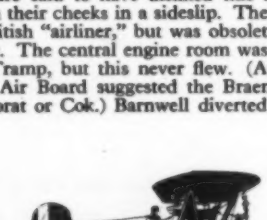
Pullman

total of 4,747 Fighters were finally built, two-thirds by Bristol (including those by Tramways at Brislington), and 4,000 were ordered for production in America. But the Americans insisted on using their own—far heavier—Liberty engine, in spite of vigorous protests by Barnwell and his Company. Alas, decisions must not be confused by facts; and, after the inevitable, the Fighter was condemned as dangerous by the US Army. Meanwhile, it continued to do brilliantly in British hands and may be said to have played a significant part towards the final victory in 1918.

Barnwell was appointed OBE and awarded the AFC, the only designer so honoured. His legendary Fighter continued in active service until 1929, then on the North West Frontier of India, and until 1932 as a trainer with the University Air Squadrons. One still lives with the Shuttleworth Trust. The Fighter was also a bread-and-butter machine to Bristol in the form of spares and reconditioning, and as a civilian it took on several post-war guises in the early struggles to establish civil aviation, or even to exist at all.

But the Fighter and Monoplane were not alone in the Bristol war effort, and Barnwell was scheming up a large triplane bomber, the Braemar, which (like the Handley Page heavies) was planned for the bombing of Berlin. The Armistice intervened, but perhaps an earlier completion might have had a profound effect on the politics and preparations of the 1930s.

The Braemar was designed by Barnwell to have a central engine-room to drive propellers through shafting, but the prototype was taken over by W. T. Reid ("chief draughtsman" at that time) and modified to take four Siddeley-Deasey Pumas, and later four Liberties. The aircraft, like the later Brabazon, was so large that it had to be drawn sideways from its erection hangar. The Braemar, first flown in 1919, was later converted to the Pullman as a luxurious airliner with a totally enclosed cockpit—but Martlesham pilots are said to have disliked this as they could not feel the wind on their cheeks in a sideslip. The Pullman was possibly the first British "airliner," but was obsolete by the time there was any traffic. The central engine room was revised for a third version, the Tramp, but this never flew. (As a matter of inconsequence, the Air Board suggested the Braemar might be known as Brusa, Korat or Cok.) Barnwell diverted his attention



Scout F

from the Braemar to pursue a new design in another biplane Scout. This was the Scout F with the Sunbeam Arab, first flown in April 1918.

While the machine itself was of no great import in the future of the company, its later engine and two personalities intimately

Roy (now Sir Roy) Fedden

connected with it have a large part to play in the rest of our history.

In the Scout F Capt Cyril Uwins, RFC, flew his first prototype for the British and Colonial Aeroplane Co. He was well known at Filton as a pilot ferrying Fighters to France, and his flying had come to the attention of the company; at their request he was released from the RFC in October 1918. In the intervening years Capt Uwins flew no fewer than 54 prototypes—four in a single year, logged a total of over 120 different types and achieved a record of unbroken flying as chief test pilot which is probably unparalleled. In 1932 he gained the world's height record in the Vickers Vespa (Bristol Pegasus) with a height of 44,000ft. And with Lord Douglas of Kirtleside (they first met when flying the Scout C) he may also claim to have flown the first commercial flights after 1918—Sholto Douglas from Cricklewood to Manchester and Uwins from Filton to Hounslow.

Capt Uwins gave up his chief test pilot position to Bill Pegg in 1947, becoming managing director of the Aircraft Division, and he is today deputy chairman of the Bristol Aeroplane Co. A revered figure, Capt Uwins has a unique place in aeronautical history.

The second personality concerned with the Scout F may claim some luck in that the Sunbeam Arab gave considerable trouble with vibration; but the Bristol Aeroplane Co (the name was changed in December 1919) may well claim more. But, as in all beginnings, we must re-trace the years. . . . In 1890 an engineering firm called Brazil and Holborrow established themselves at Fishponds, in Bristol, and in 1906 amalgamated with Straker-Squire Ltd, a Blackfriars vehicle trading concern, and so formed the firm of Brazil Straker. A young engineer, Roy Fedden by name, introduced himself to the firm in 1907 with a design for a two-litre motor-car, which was to become the "Shamrock" (perhaps for luck?) and was in production for two years.

Over the years Fedden (now Sir Roy) achieved great distinction in racing-car design, but our concern reverts to the war years and the drive for production of aero-engines. Brazil Straker were licensed to build Rolls-Royce engines, but the licence had an

Babe

important and somewhat consequential proviso that there must be no design of liquid-cooled engines. So, along with the production of the Hawk and Falcon, Fedden engaged in the design of air-cooled engines. Thus were born a Lucifer, Jupiter, Mercury, and drawing-board Hercules, taken over by the new Cosmos Engineering Co which was an offshoot from Brazil Straker in 1918.

To replace the Sunbeam Arab, the 14-cylinder Cosmos Mercury was installed in the Scout F and this historic combination flew with Cyril Uwins on October 26, 1918, the day after he joined the company. The performance was so promising that the construction rights of the Mercury were acquired by Bristol. Later, in 1919, the Badger was fitted with the Cosmos Jupiter—a name to streak across the next two decades of world aviation—and in 1920 Cosmos disappeared to become the Aero Engine department of the Bristol Aeroplane Co.

Zodiac, Cosmos, Constellations and Stars (the nomenclature system allotted to Bristol engines)—what a firmament of names and achievement; and this unique tradition is now continued by Transport Command who are giving individual star names to their Britannias. Sir Roy Fedden remained at the helm of Bristol Engines until 1942, and to him and his team credit is due for the long line of poppet and sleeve valve engines that consolidated the name of Bristol in an allied form of engineering and which, with Rolls-Royce, was so vital a consequence in the winning of the Second World War.

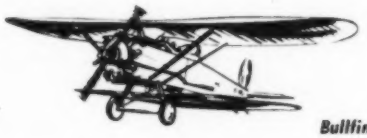
In 1919 Barnwell turned with delight to design a small biplane, the Bristol Babe, which first flew with his own 35 h.p. Viale engine and later with the 60 h.p. (nominal!) Le Rhone. Captain

Uwins was the prototype pilot (this can hereafter be taken as read), and a flock of sheep caused a precipitate take-off whilst the aircraft was still on taxying trials. Whilst the Babe was not the commercial success it was hoped, it undoubtedly paved the way for the Brownie and the later Light Aeroplane Competitions, so has some place in the light aeroplane story. Bristol had an early connection with the flying club movement, Sir George becoming president of the Bristol and West of England Aero Club in 1910. As "Bristol and Wessex," the club is now associated with the Bristol Aeroplane Co Flying Club. (It is interesting to note that the Viale engine has been recently discovered in a garage where it had been stored since Barnwell's death in 1938. After cleaning by Bristol-Siddeley Engines, it is to be presented to the Royal Aeronautical Society. A sidelight of history is that S. M. Viale had by 1919 become chief designer of Siddeley-Deasey and was to re-design the Jaguar [ex R.A.F. 8], the Jupiter's great rival.)

An authentic Bullet (as distinct from the 1914 nickname of the Scout C) was Type 32, built around the Jupiter I and raced by Uwins in the Aerial Derby and King's Cup Races of 1920, -21 and -22.

Now that the war was over, the vast aircraft industry had to contract suddenly, and the advent of the '20s was to be a hand-to-mouth existence, living on small Air Ministry orders, and introducing civilian aircraft into a new means of transportation that was frustratingly slow in its growth. So it was for Bristol; and whilst theirs had been mostly a military association, the Pullman, civil Fighters, and the 10-Seater of 1924 were genuine attempts to enter the civil field. That day was to come, but not until after a Second World War.

Meanwhile, the first was barely over, and economy was the order of the day. In this spirit was produced Type 52 in 1922, an ingenious machine adaptable as either single-seat monoplane fighter or two-seat reconnaissance biplane. The Air Ministry naming system called for a bird name for a single-seater and an

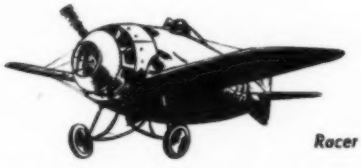


Bullfinch

animal name for a two-seater—a problem here. "Platypus" was declined by the Air Ministry. "Pegasus" was ruled out as being reserved for engines and the solution was as ingenious as the aircraft—Bull*finch* and *Bull*finch.

In 1920 Barnwell read a paper before the Cambridge University Aeronautical Society, and in view of the current competition, it is astonishing to note that this was on the subject of man-powered flight. The reference is Bristol Type 65. But to the capabilities of such a man this was fiddling stuff. Barnwell sought new fields and in 1921 took a technical commission as a major in the RAAF.

He returned in 1923 to be re-appointed chief designer, with Frise as assistant and Tinson as chief draughtsman. Reid left to join Canadian Vickers, but left behind a prophetic machine in the Bristol Racer. This bristled with innovations, most of which failed or did the opposite of their intention. As it would reach



Racer

only 160 of the expected 220 m.p.h. and was also somewhat alarming in its behaviour, Cyril Uwins very wisely declined to race. It was a brave failure, but a pointer to what would be standard practice in 1939.

We have noted the purchase of Cosmos Engineering in 1920, considered to be a foolish act at a time when the axe was cutting off Government contracts in all directions, and the market was flooded with surplus aero-engines. But with Fedden's technical inspiration, and Sir Henry White-Smith's flair for selling, there was to be a future.

Early efforts to secure Government contracts for the aero-engine department were unavailing, but there was a change of fortune when a licence was sold to the Gnome and Le Rhone company in France; it was not until 1923 that Air Ministry gave a specific production order for the 436 h.p. Jupiter IV. Since that date a Bristol engine (or engines) have been in continuous service in the RAF and in British civil aviation.

Between 1920 and 1930 over 14,000 Bristol engines were produced, and by 1939 formed a majority of those in RAF service.

On the aircraft side, there were a series of experimental machines —Taxiplane and School Machine, Jupiter Fighter and Jupiter School, Bloodhound, Brownie (which won a second prize, was flown by the Bristol and Wessex club, and was neatly perched by Barnwell in a tree at Farnborough), Boarhound, a machine to be sold to Chile called the Borzoi (a mystery to be further investigated), the Badminton with the helmeted Jupiter, and the Fighter Biplane which nearly won the King's Cup Air Race in 1928.

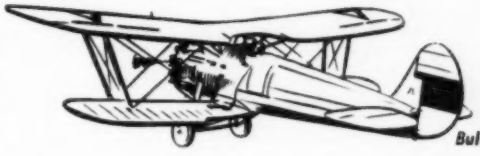
In the hard search for orders and by way of development were the Brandon, Berkeley, and—most significant—the monoplane called the Bagshot (originally the Bludgeon). This was intended to fit the specification for a twin-engined cannon fighter—in this

Bagshot

respect it might be called the forebear of the Beaufighter, though it was more significant in its structural innovation. The cantilever wing underwent considerable flexing and aileron reversal, to the surprise of C. F. Uwins and his assistant pilot T. W. Campbell. But whilst a failure in itself, it led to intensive research in metal wing structure and the Bagshot may well be seen to have fulfilled itself in the Bombay, and again in the Freighter.

Without orders, these were the days of aircraft doldrums, days of trial and experiment—mostly of aircraft as vehicles in which to try out developments in Bristol engines, including the fundamental development of the sleeve valve. (Sir Roy Fedden is to give the Barnwell Memorial Lecture on March 10, and a résumé of his paper—*The First 25 Years of Bristol Aero Engines*—will appropriately cover the engine history of the Bristol Aeroplane Co.) But aircraft fortune changed again on May 17, 1927, when an as yet unnamed single-seat fighter took off at Filton. This was Bristol's entrant for the competition for re-equipment of RAF fighter squadrons—to become the Bulldog. Said by its pilots to be a delight to fly, the Bulldog was, from its public debut at the 1929 Hendon Show, the RAF standard single-seat fighter until 1936. A total of 474 were built for the RAF and seven other air forces. One remains, now rebuilt at Filton and awaiting its Jupiter engine.

From 1927 followed the Bullpup, the Long-Range—intended for the distance record but as it was preceded by the Hawker Horsley, used as a test-bed for the Jupiter XF (which in 1929 flew 250 hours as a sealed unit), the 5-seat Biplane, general-purpose 118



Bulldog

and 120 (un-named, as Ministry prototypes without production orders ceased to be named from 1927), and the single-seat fighter Type 123 with the steam-cooled Rolls-Royce Goshawk.

World Height Records with Bristol Engines

Year	*Pilot and Country*	*Aircraft*	*Engine*	*Height (ft)*
1929	W. Neuenhofen (Ger.) ...	Junkers W.34	Jupiter	41,795
1932	C. F. Uwins (GB)	Vickers Vespa	Pegasus	44,233
1934	R. Donati (Italy)	Caproni	Pegasus	47,360
1936	Sqn Ldr F. R. D. Swain (GB) ...	Bristol 138	Pegasus	50,236
1937	Flt Lt M. J. Adam (GB) ...	Bristol 138a	Pegasus	54,252
1953	Wg Cdr W. Gibb (GB) ...	E.E. Canberra	Olympus	63,668
1955	Wg Cdr W. Gibb (GB) ...	E.E. Canberra	Olympus	65,890
	With compression-ignition engine			
1934	H. Penrose (GB)	Wapiti	Phoenix	27,453

Of the many height records held by Bristol engines, the first was in 1929 (Germany), followed by Cyril Uwins in 1932 in the Vickers Vespa with a Pegasus engine. Later the Bristol combination of Type 138 and Pegasus was twice to gain the record with RAF pilots, the above table giving details. It is believed that the Phoenix record still stands. Another Bristol/Westland connection was the first flight over Mount Everest.

Following the Bulldog, Bristol's next Service aircraft was the Bombay of 1935. Little happened about it until 1939, with the realization that the RAF had no counterpart to the Junkers 52, the Bombay then being put into production at the Belfast works of Short & Harland. This RAF work-horse saw considerable ser-

Beaufighter "Flight" photograph

FIFTY BRISTOL YEARS . . .

vice throughout the war, playing a particularly gallant part in the evacuation of British troops from Greece.

In 1934 Bristol exhibited the fuselage of Type 142, a structure clean and stress-skinned and intended for a commercial transport

Type 138a

with two Aquila sleeve-valve engines. The design was brought to the notice of Lord Rothermere (partly by the editor of the Bristol *Evening World*, who introduced Sir Roy Fedden) and an order was immediately placed for a similar aircraft. This flew in 1935, and from a tour of European capitals challenged the best RAF fighters of the day—to win handsomely. Accounts vary from 50 to 100 m.p.h. faster, but the point was made! Lord Rothermere presented the aircraft—as *Britain First*—to the nation.

Bristol quickly evolved a mid-wing bomber version, and so was born the immortal Blenheim, destined to play a historic part in still-recent dark days. From Blenheim I it progressed to Blenheim IV; 4,544 were built at Bristol and by shadow factories, and apart from its massive effort with the RAF and Commonwealth Forces it was sold to Finland, Turkey, Greece, Yugoslavia and Rumania.

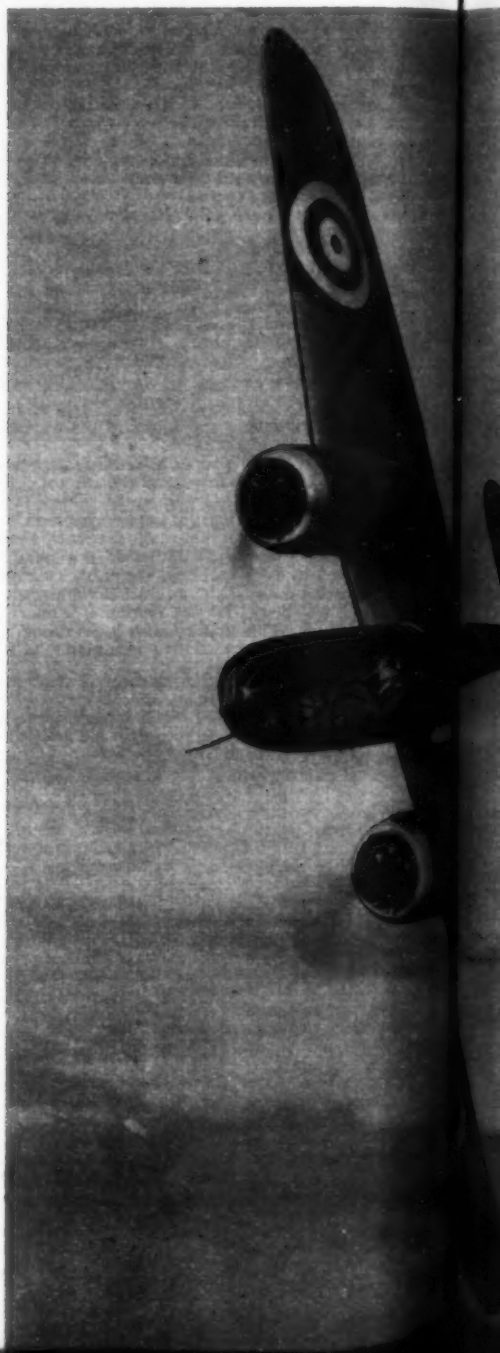
One Finnish Blenheim is still airworthy, and awaits the philanthropy of some organization to fly it back home as a memorial to

Bomber

the type and the many who flew and died with it. Indeed, one does remain as an inaccessible memorial to the conflict in North Africa, and was recently found in the depths of the Sahara Desert by an oil survey party. It had lain undisturbed since the day it crashed, and its full history is as yet untraced.

But we must return to the pre-war days. A most promising design was the 133, a small monoplane fighter of 1934, with a

Blenheim IV



ern conveniences, which might well have had a great future. a flat spin forced T. W. Campbell to abandon his mount, and circumstances of the rising urgency of re-armament forbade her work. Type 146, another radial fighter, suffered a similar in a taxying accident; and there was even an army-co-ation type, 148, which gave way to the Lysander.

Type 138a was built for special research at high altitude and in 6 and 1937 gained the world record, flying from Farnborough h RAF pilots. A special flying suit with a "space-man" helmet developed, which looks modern today, and on the second ord flight almost certainly saved the life of Flt Lt Adam, when cockpit cover cracked.

Also born of the momentum of re-armament was the Beaufort, mbolic of the acceleration of technical development in that it to replace the biplane Vickers Vildebeest. The Beaufort be-e the standard torpedo strike aircraft of Coastal Command n 1940 to 1943, to the great detriment of enemy shipping by h torpedo and mine.

As the Bristol Scout with the BEF in 1914, so the Blenheim was first RAF aircraft to see action in 1939. Within an hour of the laration of war, a Blenheim was on reconnaissance and the

"Flight" photograph

Beaufort

first shots in anger were from Blenheims in an attack on the German Fleet. We may remember that both were among the first and last designs of Capt Frank Barnwell. This retiring man and outstanding designer met his death in 1938, in a small monoplane of his own design.

From the success of the Beaufort was born, as a private venture in the first instance, the Beaufighter, with the standard parts of the

Britain First

Beaufort excepting the engines and fuselage, now redesigned to the slimmer lines of a fighter. The first line of the Beau was drawn by Alec Symon, OBE, now chief of sales engineering at Bristol, and under L. G. Frise, who had taken over as chief designer on Barnwell's death. How does one even start to tell of the Beaufighter? Here only very inadequately, and to say that with machine-guns, cannons, rockets and torpedoes it blasted the enemy however and wherever he chose to fight—and whoever, for as "Whispering Death" it was well known to the Japanese.

The chronicles of the war years are of contemporary knowledge, but before speeding our story to later days, it is worth remembering the great names that Bristol gave to those desperate years—Blenheim (Bisley and Bolingbroke), Beaufort and Beaufighter, totalling 14,000 aircraft. And there were Jupiter (still, if only just), Pegasus, Mercury, Taurus, Perseus, Hercules and Centaurus—for 107,000 Bristol engines were produced in World War Two. How soon we forget.

1946 cannot compare with 1919. Then, the achievement of British aviation was left to moulder by a disinterested public, whilst now the lesson was fully learned and the advent of jet propulsion offered great advances in speed and height. But it did not come all at once, and there was a transition period.

As late war types for which contracts were cut back, the Buckingham and Brigand saw limited production, and the latter was to achieve some fame in Malaya against the Communists. The Buckmaster was the trainer version.

But as in 1919, Bristol ventured into the civil field, and this time circumstances were favourable. Cyril Uwins flew his last prototype in 1945, and the bulbous Freighter was introduced to an astonished and somewhat sceptical world. Fixed undercarriages were a thing of the past—except when you consider the Freighters (15 years later) crossing the Channel with Silver City and achieving astronomical statistics, the Freighters in Spain, in France, in

Brigand

Pakistan and in New Zealand, not to lengthen the list. Over 200 Freighters (alias Wayfarer) were built.

From the recommendations of the Brabazon Committee came the giant of British aviation—the Bristol Brabazon. The year 1949 perhaps knew more speculation and excitement in the first flight of this great Atlantic hope than in any other event of that time. It

FIFTY BRISTOL YEARS . . .

was not just aviation but world news, and the story was carried by every English-speaking newspaper—possibly by every newspaper the world over. Brabazon I with eight coupled Centaurus, and II, intended for coupled gas-turbine Proteus, were broken up and sold for scrap. The reasons, and the controversy, have no place here; yet but for this great technical achievement and its require-

Brabazon

ments, there would be no great runway at Filton and no great Assembly Hall—and because of the advance in technology, possibly no Britannia.

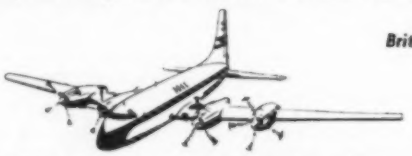
The prototype pilot of both Brabazon and Britannia was A. J. Pegg, who had joined Bristol in 1937 after service in the RAF; "Bill" Pegg handed over the controls to Walter Gibb in 1956, to become helicopter service manager at Weston-super-Mare. *Sent Flying*, recently published, tells Pegg's own story.

Walter Gibb joined Bristol as an apprentice and returned to Filton after a distinguished RAF career in which he won the DSO and the DFC with Bar. Gibb later undertook much of the exacting piloting required for the icing trials of the Proteus, and with the Britannia became a familiar figure on the African and Indian routes in search of cumulo-nimbus clouds.

The Brabazon was the last of L. G. Frise's designs for Bristol, and his place—first as chief designer and later as chief engineer—was taken by Dr A. E. Russell, a graduate of Bristol University who joined Bristol in 1926.

Dr Russell was to father and foster Type 175, now well known on international routes as Britannia: the nickname "Whispering Giant" seems almost forgotten, but this gracious airliner is still the quietest of aircraft.

The landing of G-ALRX in the Severn mud (a wonderful feat by Bill Pegg) arising from stripped teeth in the reduction gear of a Proteus, the structure fatigue tests following on Comet disasters (tests which proved the Britannia's splendid structure), the Proteus icing troubles—all these problems became the responsibility of the chief engineer and a cause for much anxiety to



Britannia

Bristol and BOAC. The early days of Britannia service were also trying times, with public interest in every minute's delay and every minor defect.

That the Britannia is now hardly mentioned is, by contrast, as great a compliment. But just for the record, it is in service (and doing splendidly) with BOAC, El Al, CPA, the RAF, Hunting Clan and Air Charter, Aeronaves de Mexico, and in Cuba and in the Argentine. Eighty Britannias have been built and sold—and years hence these pages will still have much to tell of Britannia and Proteus.

Bristol's association with Belfast has been continued with Britannia production and in the current design of the Britannic, for which Bristol is responsible for wing design and production. The chairman of Short Bros & Harland, and of Bristol Aircraft from 1957, is Rear Admiral Sir Matthew Slattery, CB, DSC, FRAeS, RN(retd), and it is of note that Bristol Aeroplane has a financial holding in the Belfast company.

Sir Roy Fedden left Bristol in 1942 (taking part in some of the early design work on the Theseus, Bristol's entry into the gas-turbine era), and was followed by N. Rowbotham, R. L. Ninnes and later by F. Owner, who projected the Proteus. Under Dr S. G. Hooker and Dr Warlow-Davies Bristol has produced the Olympus and Orpheus, powering such diverse aircraft as the Avro Vulcan and the Folland Gnat.

Bloodhound

The chairman and managing director of Bristol Aero Engines Ltd from 1951 to the amalgamation with Armstrong-Siddeley as Bristol-Siddeley is Air Chief Marshal Sir Alec Coryton, KCB, KBE, MVO, DFC. Sir Alec remains with Bristol-Siddeley at Patchway, and it is interesting to recall that in 1919 he taught King George VI to fly.

A Northern god to join classical mythology is Thor, to power the (second) Bloodhound, and one of the first of production ramjets. Bristol was early with the setting up of a British Guided Weapons Department, and has had exceptional success with Bloodhound, now in the RAF and Swedish Air Force and also destined for Australia. The chief designer of G.W. from its inception has been David Farrar, OBE, FRAeS, who was responsible for the structural design of the Brabazon.

The fixed wing chief designer is Dr W. J. Strang, FRAeS, once a Bristol apprentice. In a fashion somewhat recalling his distant predecessor, Capt Barnwell, he went to Australia and then returned to Filton. The third chief designer (until the recent merger) under Dr Russell was Raoul Hafner, FRAeS, a name synonymous with that of British rotating wing aircraft. Starting his early experiments in Austria, he built and flew his Hafner Gyroplane before the war: during hostilities he was with the Airborne Forces experimental section—with a flying road jeep (a "Rotabuggy") and a small "Rotachute" that fitted into the rear gun turret of a Wellington. He joined Bristol with the coming of peace.

The Sycamore is surely one of the classic helicopters, and even at this late date is giving good service in many parts of the world. As a contribution to the export drive with Britannia, Freighter, Bristol engines and licences, some 50 Sycamores are with the West German Air Force. (And of licences—the Canadair maritime

Sycamore

Type 192

reconnaissance Argus and CL-44 are direct descendants of Britannia. The Britannic is perhaps an indirect descendant.)

Following the Sycamore was the twin-rotor 173, now developed into the 192 for RAF service, but as yet un-named.

As assistant chief engineer to Dr Russell is Mr H. Giddings, FRAeS, long with Bristol and originally with Parnall Aircraft. Managing director of Bristol Aircraft, and an international figure in aviation, is Peter G. Masefield, now President of the Royal Aeronautical Society, who joined Bristol from BEA in 1955. It is interesting to recall that Mr Masefield signed the Britannia contract when with the Ministry of Civil Aviation.

During the war the various departments of the Company were grouped into Divisions under a Head Office: these divisions, four in number by 1955—Aircraft, Engine, Car and Buildings—then became three subsidiary companies, Bristol Aircraft Ltd, Bristol Aero-Engines Ltd, and Bristol Cars Ltd. From this time Bristol aluminium buildings were discontinued, but cars have continued with a series of high-class models built under the chairmanship of Mr George White, grandson of the founder.

Sir Reginald Verdon Smith and Mr George White became joint assistant managing directors in 1947, and joint managing directors in 1952, two years before the death of Sir William Verdon Smith, who had been chairman for 25 years.

The family tradition has survived this astonishing 50 years, and covers almost the whole period of powered flight in Great Britain. And Sir Stanley White, as witness the original letter-head, was there on February 19, 1910.

Fifty years from feeble flight to lunar rocket—and a time of vast change. And just before this 50th anniversary have come more changes in a changing pattern of military requirements, international politics, commercial competition and financial developments.

These changes have come about, with engines, aircraft, cars and helicopters, within the last year, and some of very recent

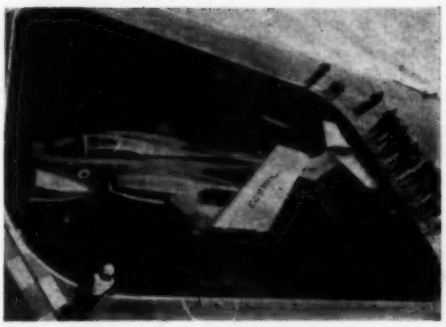
Type 188

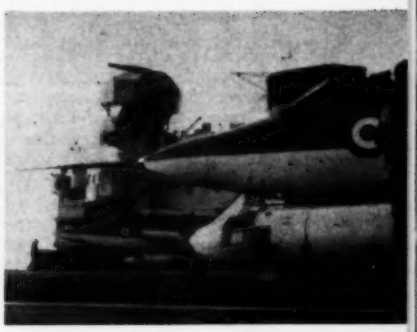
announcement. There is a certain sadness in this, but also a sign of that flexibility in a company which can change, with others in the industry, to meet the even greater innovations of the day. The end of one fifty-year period is but the beginning of another, and *Flight* for February 19, 2010, will doubtless record another anniversary—and tell of the all-steel 188, more world records, and. . . .

NA.39 GETS ITS SEA LEGS

THIRTY take-offs and landings were recently completed by Blackburn NA.39s on HMS *Victorious* in 3½ days' development flying. These trials were carried out—only 21 months after the first NA.39 flew—by two aircraft: XK523, the seventh to be built, and XK489, the fourth. Blackburn chief test pilot Lt Cdr Derek Whitehead flew XK523 direct from the company's test airfield at Holme-on-Spalding Moor to *Victorious* in the Channel, accompanied by Blackburn flight observer Mike Bailey. The other NA.39 was flown out from the A & AEE at Boscombe Down by Cdr P. Price, who commands "C" Sqn, with Ernie Lack (of Blackburn) as flight observer. Other pilots taking part were Lt Cdr T. C. Evans, also of "C" Sqn at Boscombe Down, and Lt Cdr E. R. Anson, RN, who is on loan to Blackburn. Lt Walsh of the Royal Navy flew as observer in the rear seat on some of the tests. The Blackburn technical team aboard *Victorious* numbered nearly 30 with Roy Boot, NA.39 development officer, in charge.

During the trials a full assortment of weather conditions was experienced, from gales to flat calm. These photographs show a take-off, with the catapult strop falling away; an NA.39 on the hangar lift, with wings and nose folded and air brakes open; the two aircraft, and two Blackburn starter pods, on the flight deck; and an approach over the seething high-speed wake of Britain's most advanced carrier.





Straight and Level

IT seems to be generally accepted that an airline passenger has to fly 100 million miles before, statistically speaking, he gets the chop. This is the "acceptable" fatality rate—1.0 per 100m passenger-miles.

Everyone knows that this is not a perfect index of airline safety. A small local service airline can fly for 20 years in perfect safety, suddenly lose a DC-3 through no fault of its own, and find itself with a safety record apparently ten times worse than a big long-haul airline that has had half a dozen culpable fatals. So the "1.0 per 100m" index has always to be carefully qualified.

And it seems that eventually it will have to be rejected. In 1969, if air traffic continues to grow at (let's say) ten per cent per year, passenger-miles flown will amount to 153,000 million. Using the aforementioned index, 1,530 passengers would be killed in 1969. This means, assuming an average of 25 fatalities per aircraft compared with 15 in recent years, that throughout 1969 there will be a civil air disaster somewhere in the world every six days. How about a new index?

* * *

Looking further ahead, to the days when Sir Charles Boost's great-grandson is chairman of Plummet Space Lines, let's suppose a twice-weekly service to Mars is operated with 50-seat Scruggs Plasma Spaceliners. The old familiar 1.0-per-100m safety rate would still be achieved even if every other Spaceliner blew to bits on the launching pad or vanished into the Cosmos.

● "The accident shows the importance of modern aircraft using the newer type of fire-resistant hydraulic fluid which the chemical industry has developed."—*Sir Miles Thomas, chairman of Monsanto Chemicals, "Daily Telegraph," January 9.*

"Was it strong Irish whiskey that burned out the fuselage of the BEA Viscount when it landed in fog at London?" —*the "Daily Herald," February 5.*

● "It would appear that there is no prospect of BOAC and BEA being able to go to the open market so long as they have to go on placing orders for new and increasingly expensive aircraft at relatively frequent intervals. For example, the possibility of having to finance supersonic aircraft arises in the case of BOAC. We must accept that the airline industry nearly everywhere in the world must continue to operate with some measure of public support."—*Geoffrey Rippon, Parliamentary Secretary to the Ministry of Aviation.*

I rang my old friend Sir Charles Boost for his views on these remarks. You may recall that a previous statement by Mr Rippon ("We have to pioneer or perish") was adopted by Sir Charles as the Boost family motto.

"Splendid, old boy, absolutely splendid," he said. "It is the duty of all governments to foster and encourage the highest possible rate of airline re-equipment, to let them buy what they want as much as they want when they want, and to ensure that massive public support is always available merely for the asking. Only without government interference and by giving the airlines their heads can we have a stable airline industry."

Here is a picture I've been saving up for you for 40 years. The Avro 748, due to be in UK domestic service in about a year's time, should settle the threatened railway strike, if it's not settled by then. For the railways there is some real competition coming up, or down, from the air

● "There is a school of thought," wrote a contributor in an article on transport interiors in *Flight* of January 22, "that would abolish the hat rack altogether. With passengers now seated five or even six abreast the provision of really adequate space for hand luggage is virtually impossible . . ."

I wonder if those who advocate such a retrograde step have any idea of what "hand luggage" really entails. Mine recently comprised two large Spanish baskets, an Andean sombrero, eight maturing pineapples, a small Navajo Indian rocking horse, a 4ft Bambi doll, two brief cases, a competing airline's overnight bag, a Medallion camera, a drip-drying mackintosh, and an umbrella.

Try making *that* the design case.

● Two thoughts struck me when I first heard that delivery of BOAC's Boeing 707-420s would be delayed, perhaps by two months compared with the original December 1959 schedule.

First, the changes required by the ARB inevitably call into question, by implication, US jet airworthiness standards. Yet there has been no squeal from the Americans. Do you remember how our newspapers front-paged the difficulties that arose over US certification of PanAm's Comet 3s and North-east's Britannias? Thank goodness that no "British jet supremacy" slant has been put on BOAC's 707 troubles.

Second, it seems that BOAC are absolutely fated to suffer delays—technical or industrial—in the introduction of new aircraft. So far, say Boeing, every 707 delivered to eight airlines has been ahead of, or on, schedule. But not BOAC's. Theirs, by one of Fate's unpredictable backhanders, will be the first to be late, with all that this will mean in lost revenues and increased costs.

● Did you count the number of Hunters in that Treble One over-the-top formation which made *Flight*'s centre spread last week? There were in fact six, including the photographic aircraft. This was a T.7 flown by Flt Lt Brian Mercer, who has since left Treble One (as a squadron leader and with an AFC for his work). Mick Chase was the Air Ministry photographer, employing a Speedgraphic 5 × 5 with his inverted eye.

I need hardly say that, barring automatic cameras, this is about as close as most of us will ever get to being in an aerobatic formation. It was certainly close enough for me.

● Recent traffic statistics published by BEA indicate that the corporation's 1959 load factor was 11.1 per cent up on that for 1958. But subtract 60.1 per cent from 66.8 per cent and you get 6.7 per cent.

It seems that the statisticians are presenting us with a percentage of a percentage. Which, with the greatest respect, is an example of how very clever people can sometimes be a little bit silly.

● Inspired by the news-agency message which graced this column last week I have now composed this "Ballad of the X-15" to the tune of *Waltzing Matilda:*

Coming in tola,
Nbjwre in the engineo,
Spoiled byh nbjwre—no 'blgood
No 'blgood—njbwre in the engineo,
Home to the Forczhbase
We'll go like a bojmre.

ROGER BACON

Supersonic Transports at the IAS

By DON ADAMS

FOR the second year in succession the Institute of the Aeronautical Sciences devoted a full morning session of its annual meeting—held once again in New York City's Astor Hotel—to the subject *Supersonic Transports*. At last year's meeting (*Flight*, February 6, 1959) technical papers had been presented by representatives of Boeing, Convair and Douglas. All of these companies, of course, had (and still have) under construction subsonic turbojet-powered airliners, but their interest in the supersonic field in early 1959 had been much less publicized than that of Lockheed and North American. And there was much speculation at the time as to why the two latter-named firms had not proffered their views on a subject in which both were known to have conducted many studies and design analyses. Whatever the reason for their prior silence, Lockheed and North American this year saw fit to reverse their former policy and to present highly interesting treatizes on key aspects of faster-than-sound transports.

Considerations of Design, Powerplant and Performance was the title of a paper prepared by J. B. Pearson Jr and R. J. Pfeiffer, both of whom are engaged in advanced planning activities at North American Aviation. At the very beginning of their presentation they suggested that "enough has been said and written about a supersonic transport to indicate that it is the next logical step in satisfying mankind's natural desire to travel from one place to another in the least possible time." Without covering, as they continued, "all of the ramifications of this desire for speed," it was believed reasonable to proceed on the premise that supersonic transports would be introduced *just as soon as acceptable standards of comfort, safety and cost were fulfilled*. In their opinion these requirements would shortly be met and supersonic vehicles would be in service in the 1965-1970 time period.

The impact which these aircraft would have on the world's transportation habits was expected to be far greater than the impact following the introduction of current subsonic types; however, it was not the purpose of the authors to dwell on that point. Instead, they delineated a set of design requirements and discussed the influences which various parameters had on the three basic factors of comfort, safety and cost. A range of 3,500 n.m. (with reserves) was deemed acceptable for "eighty per cent of the world airline routes." Obviously, in their minds, at least, the highest speed obtainable without seriously affecting the other design factors was desirable. Speeds below Mach 2 appeared to have no substantial advantages over high subsonic speeds, while speeds above M3 required significant technological advances if the aeroplane were to become operational in the intended time period.

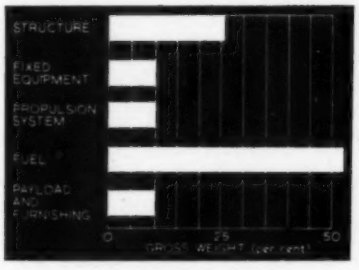


Fig 1. Weight factors

A design velocity in the M2/3 range was hence considered advisable; that requirement suggested a relatively high cruise altitude, which would both reduce ground noise—due to shock waves—and provide for smooth over-the-weather flight. "Economic factors would dictate the design passenger load," according to Messrs Pearson and Pfeiffer. Small passenger loads with a high frequency of flights were considered optimum from the standpoint of operating schedules (Fig 1). Operating costs of 3 cents per seat-mile would give a net return comparable to that experienced by existing types "under similar conditions of fares, load factors, utilization and range." Noise of the supersonic transport must be no greater than the subsonic turbojets, and runway requirements should not exceed 10,500ft at sea level. A growth factor of 6* was forecast for a representative steel-honeycomb M3 transport; however, for those items which influenced aerodynamic drag, the growth factor might be as high as 10. Steel honeycomb construction was considered necessary for reasons of aerodynamic heating. By virtue of its "biaxial load carrying ability," honeycomb sandwich was particularly well suited to low aspect ratio delta wing configurations. Careful design would permit operation at 80,000ft altitude. Such flight "will be as reliable as current operations." The penalty incurred by the inclusion of windows in the passenger compartment was calculated to be 2,000lb, which would cause an increase in take-off weight of some 4 per cent, for a 100-passenger transport. Primary flight controls would be of the fully powered irreversible type.

Afterburning turbojet engines were considered by the authors to be superior to non-afterburning "dry" propulsion systems for two main reasons: (1) they had a superior thrust-to-engine-weight ratio; and (2) they had greater thrust per pound of engine airflow (specific thrust) because of relatively higher temperatures. For these reasons, the afterburning turbojet was a smaller, lighter unit which could be expected to have the least aerodynamic drag. From an installed weight viewpoint, the afterburning engine was

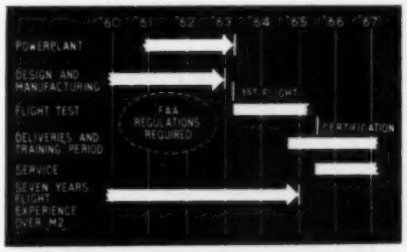


Fig 2. Availability of supersonic transports

better than a turbofan, but "present indications are that the turbofan engine with fan burning represents the best compromise and has the greatest development potential."

Not surprisingly, North American Aviation's configuration studies favoured a delta-wing canard arrangement—no doubt quite similar to the B-70, F-108 layouts. Buried engine installations were preferred over external engine mountings.

In sum, the speakers observed that a firm go-ahead, given now, would mean that supersonic aircraft could be in scheduled service by 1965 "with a level of risk comparable with the introduction of current jet transports" (Fig 2). By that date America would have had more than seven years' experience with large M2+ aircraft. North American Aviation alone had performed no less than 14,000hr of wind tunnel testing on Mach 3 configurations. A first-flight date as early as 1963 was feasible, but in any event attention had to be paid to noise reduction, low fuel consumption, take-off and landing characteristics and high reliability.

Lockheed's contribution to the meeting was a paper by B. C. Monesmith, vice-president and general manager, and R. A. Bailey, chief engineer, on *Supersonic Transports—Operational Factors, Financial Considerations and National Policy*. Field length requirements, because of the supersonic transports' excellent take-off performance, would certainly fall within the 10,500ft limitation suggested some months ago by James Pyle and endorsed by the previous speakers. Landing distance would not be critical in view of the supersonic aircraft's expected wing loading of 40-45lb/sq ft. Airport noise might be a problem, but if the 112db perceived noise level limitation proposed by the New York Port Authority proves to be a valid criterion, "the supersonic transport will present *less* of a problem in terms of community noise than the present subsonic jet." The cabin floor angles of supersonic airliners (Fig 3) would be higher than at present; however, due to the short period—less than three minutes—during which these angles would be evidenced, "passengers

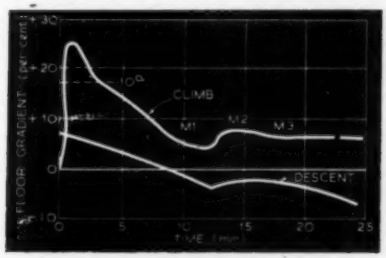


Fig 3. Climb and floor gradient

**Hence for each one pound increase in fixed weight—e.g., payload—the take-off gross weight would rise 6lb for equivalent performance.*

Supersonic Transports at the IAS . . .

should suffer no great discomfort." A typical climb-out to cruise altitude would encompass the following three steps: (1) climb at a constant equivalent airspeed of 312kt to 37,500ft; (2) a constant altitude acceleration at 37,500ft to an equivalent airspeed of 550kt; and (3) a constant equivalent airspeed climb at 550kt to M3 cruise altitude (70,000ft). Descent would be initiated some 350 n.m. from destination at a constant equivalent airspeed of 312kt. Cabin floor angles would vary between plus and minus 7 per cent.

A 250,000lb steel M3 transport might cost upwards of $160m to develop, while a 500,000lb supersonic aeroplane could run as high as $210m. The former figure, according to the speakers, was one-third greater than the development cost of today's 300,000lb subsonic turbojets. These data were based on assumed sales of 100 supersonic and 200 subsonic aircraft. The initial cost of a M3 250,000lb faster-than-sound transport would hence be approximately $11m, while the 500,000lb supersonic aircraft might each cost roughly $20m. Despite these apparently large sums, Lockheed studies had shown that "the small supersonic transport's superior work capability will provide a profit potential greater than that of the subsonic jet." As the speaker put it, "The supersonic transport is technically feasible as well as financially sound."

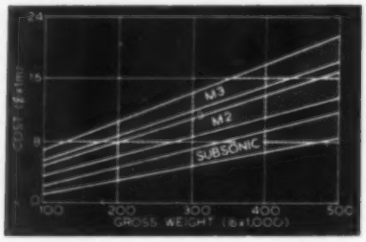


Fig 4. Estimated first cost per aircraft for 100 units

Points from the Lockheed representatives' summary included:

"In the supersonic transport, the United States has an opportunity to demonstrate to the world its technological leadership over the Soviet Union. In our opinion, the government would be justified in supporting the development of a supersonic transport simply for national prestige, not to mention all the other reasons. Such a programme would not be without precedent. We have only to look at the shipbuilding industry, where substantial funding by the government is represented in our fleet of privately operated flag bearing vessels. A recent example would be the world's first nuclear merchant ship, *Savannah*.

"When military applications of the supersonic transport are considered, it should be noted that a properly 'sized' aircraft can fulfil the 'multi-mission' concept as defined by Gen Thomas D. White, US Air Force Chief of Staff. Studies indicate that it can accomplish at least the following military missions: (1) supersonic tanker; (2) recoverable booster; (3) reconnaissance; (4) MATS cargo-passenger; (5) special air mission.

"While the value of the supersonic transport to the nation warrants serious consideration in terms of substantial Government support, we in industry must recognize our responsibility. When we consider the challenge and all its implications, it is obvious that our system of free enterprise and individual initiative is being put to the test. We, of the air industry, are being challenged—and the outcome will have far-reaching effects. It may very well represent a turning-point in our history.

"To meet this challenge, new and unique approaches could be utilized to finance development of a supersonic transport. Seriousness of the problem demands some fresh thinking, new approaches and fast action. We could already be behind—and not know it. We cannot afford to lose much time arguing and waiting between sessions of government bodies.

"A supersonic transport could move into production if the airlines of America would pool their resources. One basic aircraft could serve all airlines. And, anyway, it is doubtful if more than one design would prove practical economically. . . .

Rounding out the session were two papers by members of two non-profit-making—but no less enthusiastic—organizations. Speaking on *Noise Aspects with Emphasis on Sonic Boom* were Messrs Lina, Maglieri and Hubbard of the Langley Research Center. The noise problem was not unknown to the airline industry, but a new source of noise—the shock wave pressures produced by sonic booms—would cause some aggravation to an already serious problem. Two strong shock waves, one at the bow and one at the tail, were created by supersonic aircraft. NASA had recently made available the results of wind-tunnel and flight test measurements of the shock-wave pressures at large distances from the source of the disturbance. Amongst the actual flight data were results of a series of M2 test flights at altitudes up to 60,000ft. One of the quantities measured during these tests was the rise in ground pressure, and, if subsequent projections for the data for M3 supersonic transports (at 70,000ft) were valid, "there is a good chance that *several million* people would hear the booms produced by a supersonic flight from coast to coast in this country."

Clean aerodynamic design was deemed compatible with the requirements for minimizing shock-wave noise, and apparently no special aerodynamic tricks (other than low drag design) would effectively reduce the sonic boom. Mach number was considered the "least significant" of the parameters influencing noise, once the speed range at which the booms were first produced was exceeded. For example, the authors contended that increasing the speed from M1.5 to 3.0 theoretically increased the intensity of the sonic boom by only about 26 per cent. The most significant operational variable, in their opinion, was the distance of the observer normal to a supersonic aircraft's flight path (in both lateral and vertical directions). During tests conducted with supersonic fighter and bomber aeroplanes, the noise intensity produced by flight at 60,000ft was only about one-third of the noise recorded for flights at 30,000ft. The presence of heavy overcasts seemed to have little effect on the pressure rise created by the sonic boom. Even cloud layers 30,000ft thick produced no substantial noise attenuation, according to the speakers.

Analytical theory had shown that sonic booms existed at Mach numbers slightly greater than unity; however, actual flight practice had proved that atmospheric refraction caused shock waves to be curved sufficiently to miss the ground completely at certain "cutoff" Mach numbers. The exact speed at which such cutoff occurred varied with temperature and gradients, altitude and flight path angle. Consequently, aeroplanes having good climb performance might operate at relatively high Mach numbers without producing severe noise problems. But, conversely, descents had to be made at reduced velocities to prevent sonic booms. During one test run cited by the Langley representatives, the boom produced by supersonic flight at a climb angle of 10° developed less than one-eighth the ground-pressure rise incurred by level flight at the same altitude. "In summary of what has been learned of the sonic boom problem, it appears that once a good aerodynamic design has been developed for a given size aircraft, only small reductions in sonic boom intensities could be expected from further changes in external shape. The real hope for solution to the problem lies in the manner in which the aircraft is operated."

Engine noise was also of great concern. It was obvious to the engineers from Langley Field that aircraft noise varied widely, depending upon the choice of powerplant. And if proper consideration were not given to the community annoyance problem, an engine might be employed which had unacceptable noise characteristics. On the other hand, "the possibility exists of choosing a powerplant that would be as good as, or possibly better than, those currently in use."

The final paper dealt with the *Potential VTOL Capabilities of Supersonic Transports*. Presented by R. H. Miller of Massachusetts Institute of Technology, it stated that an obvious means of improving safety during the final approach and landing of supersonic types was to increase the time available to the pilot to correct accumulated approach errors. In the author's view, the ability to approach at "low to zero speeds" (depending upon visibility) and inspect, select and reject (if advisable) a landing area would unquestionably increase the probability of safe operation. A VTOL capability could accomplish this function. The term VTOL, in so far as airline operation was concerned, implied much more than simply the ability to perform a zero roll landing or take-off under emergency power. If routine VTOL operations were to be achieved, four criteria must be met: (1) complete omni-directional flight capability at all times, regardless of wind conditions, this requirement "obviously meaning the ability to fly backwards and sideways as well as forwards, at speeds in excess of anticipated winds"; (2) complete and adequate control at all times about all axes, a necessity which implied the use of reaction-type rather than aerodynamic controls; (3) positive *position* stability at all times about all axes; and (4) a vertical flight capability even in the event of engine failure. Mr Miller further opined that the concept of a STOL aircraft with limited VTOL capabilities (at "off-loaded" gross weights), while attractive in certain military operations, "had no place in the scheduled commercial transport field, since the advantages of VTOL operation will lead to traffic control and approach techniques, airport siting and landing areas which would preclude the use of a STOL.

According to the MIT spokesman, if the engine-out condition were considered realistically as an emergency condition and not a training requirement at full gross weight, it might be permissible to allow the remaining engines to operate (for short periods) outside their normal regimes. Over-speeding and excessive temperatures might be thereby incurred, but the time required to free the aircraft from a hazardous height/velocity situation might be insufficient for the engines to reach well-above-normal equilibrium temperatures. In any event, incidents of engine failure with jet engines to date had been so few "as to warrant consideration of the overspeeding and discarding of engines in the event of failure as an economically feasible procedure."

Concluding his remarks, Mr Miller suggested that, because the landing gear of conventional transports accounted for about 5 per cent of the gross weight, the provision of a VTOL capability in a M2 transport "is just possible without loss in payload." In the case of a M3 vehicle, "a net balance of 2 per cent (in weight) in favour of the VTOL transport remains."

Seen at the Royal Aero Club air racing dinner reported in last week's issue; air racing champion Capt N. T. Baldwick, Geoffrey Rippon, MP, and King's Cup winner A. J. Spiller

Bermuda's Director of Civil Aviation, Wg Cdr E. M. Ware, with his Luscombe 8A seaplane VR-BAK. He bought it for £100 and rebuilt it himself (see news item in column 1)

Sport and Business

AT THE SOVIET EMBASSY, London, on February 3 a colour film of the 1957 Aviation Day display at Tushino was shown to a group of Royal Aero Club members. The film, which has been given to the club by the Central Civil Aero Club of the USSR, showed glider and parachuting events as well as aeroplane and helicopter demonstrations, all of an extremely high standard in both airmanship and photography. In exchange Lord Brabazon handed over a copy of the Shell film *High-speed Flight*, which the Royal Aero Club has given to the Soviet club.

TWO YEARS AGO Bermuda's Director of Civil Aviation, Wg Cdr E. M. Ware, spotted a rotting 1946 Luscombe 8A seaplane near the Colony's airfield. The owner was delighted to part with it for the sum of £100, and the DCA set about rebuilding it. In his own workshop he made a completely new tailplane, re-worked the main structural bulkheads and the Edo floats, replaced large sections of skin, installed six-channel VHF, a directional gyro and other instruments, and overhauled the Continental 75 h.p. engine and metal prop. The ARB inspected the restoration, pronounced themselves 100 per cent satisfied, and six months after beginning the rebuild the DCA was airborne in his new executive floatplane.

Since then, he told a *Flight* staff member recently in Bermuda, he has used it a good deal for hopping around the islands on business and on pleasure, and he has also completed a photographic survey of the island from 7,000ft on behalf of the Bermuda Government. He installed a war-surplus K20 vertical camera behind the seats, with remote control and levelling apparatus between the seats, and took altogether 169 pictures. The survey has helped such projects as re-afforestation planning, and there has been quite a large demand for prints. The DCA has also chartered his aeroplane on a number of occasions to commercial photographers and others, thus helping with the running costs. His eight-year-old son David "flies it extremely well," he told us, though of course not on landing or take-off, and only under supervision in the air.

The DCA's reputation as a practical aeronautical engineer as well as the Colony's senior civil aviation administrator is the subject of several local stories. One has it that when a Viscount was delayed at the airport with mechanical trouble the DCA was observed, coat off, in the vitals of the aircraft helping to put things right. There are not, we imagine, many DCAs whose enthusiasm for aviation extends to these extremes.

IRISH AIR CHARTER LTD, the Dublin-based agents for Piper and Lycoming, are moving to Kidlington Airport, Oxford, to join Vigors Aviation Ltd, an associate company. Founded in January 1957 by T. A. Vigors, IAC operated a Piper Apache on charter work until 1958 and has since concentrated on aircraft sales.

LORD BRABAZON OF TARA is expected to be the guest of honour at the annual liberation air rally to be organized by the Channel Islands Aero Club on May 13-15. At the club's recent a.g.m. it was reported that almost 600 hours were flown during 1959.

RETROSPECT

From "Flight" of February 12, 1910

Women's Aerial League (*227, Strand, W.C.*): A very successful gathering was held at the Criterion Restaurant on the afternoon of the 3rd inst., at which Mrs. Hutton received the guests, who were afterwards entertained to tea. During the meeting Mr. C. C. Turner gave a short address, explaining the objects of the League, and drawing special attention to the national need for adequate aerial defence. He said that England was behind Germany, and to be one year behind was as bad as being fifty years behind.

THEN AND NOW

Gipsy Moths at Marsden, Gloucestershire in 1928, and Tiger Moths and a Turbulent at Redhill, Surrey in 1960, each accompanied by a group of light-aircraft enthusiasts. One other feature which the photographs below have in common is Mr Norman Jones, seen on the extreme left in each picture. With him in the 1928 shot are Nigel Norman, Alan Muntz, Dr Whitehead Reid and Alan Butler, while 32 years later his colleagues are members of the Tiger Club and (in the rear row) of Imperial College Gliding Club. Redhill is the operating base for both of these clubs; Marsden was the home of Lady Norman.

Pride of Transport Command: a Comet of No 216 Sqn escorted by one of the Lyneham-based Britannias which are used jointly by Nos 99 and 511 Sqns

SERVICE AVIATION

Royal Air Forces and Naval Flying News

Premier Squadron

AWARDED for "the year's finest feat of aviation in the Royal Navy," the Boyd Trophy has gone to No 781 Communications Sqn "for the outstanding way in which they met exacting tasks during 1959."

Based at Lee-on-Solent, the squadron is the smallest in the Royal Navy, with six Sea Devons and a Whirlwind. Last year it flew a total of 4,200 hr by day and 50 by night, carrying 2,720 passengers and 100,000lb of freight without incident and "to a meticulous timetable." In a message to the FAA the Flag Officer Air (Home), Vice-Admiral D. E. Holland-Martin, commented: "This performance has reflected the greatest credit on the squadron's aircrew and maintenance personnel, and indeed the Royal Navy. I warmly congratulate 781 Sqn on their achievement."

Air Commodore Posts

TWO senior RAF postings have been announced. Air Cdre A. R. D. MacDonell is to be Director of Work Study at Air Ministry from February 29 and Gp Capt J. A. Robinson becomes Chief Signals Officer at Bomber Command headquarters (with the acting rank of air commodore) on February 22.

Air Cdre MacDonell, who is hereditary 22nd chief of Glengarry, has been commanding RAF South Cerney since returning in 1958 from Moscow where he was air attaché. During the Battle of Britain, when commanding No 64 Sqn, he was twice shot down; then in March 1941 was taken prisoner, being repatriated in 1945, when he was mentioned in despatches. He had been awarded the DFC in 1940.

Gp Capt Robinson is Senior Technical Staff Officer at Signals Command and formerly (1955-57) was Chief Signals Officer at FEAF headquarters. In 1941 he was mentioned in despatches and in 1945 made an OBE.

Mounted as if in flight, and as yet uncamouflaged: the Griffon-engined Spitfire at Perth, Western Australia (see item above)

Spitfire in Perth

BELOW is a photograph of the Supermarine Spitfire 22, PK481, which was shipped to Australia last year and has now been erected as a war memorial outside the headquarters of the West Australian Division of the Air Force Association. The stand on which it is mounted was designed and made by Vickers Hoskins Pty Ltd, of Perth, and had to allow for the weight of the aircraft and its Griffon engine as well as for possible wind forces. Funds to bring the Spitfire to Australia were raised by public subscription, with contributions from Vickers Australia Pty Ltd and Rolls-Royce Ltd. It has since been camouflaged with correct wartime markings.

Changes Down Under

GIVING further details recently of proposed RAAF changes the Chief of the Australian Air Staff, Air Marshal Sir Frederick Scherger, said that the first major one would be in the Home Defence Forces. In future, Citizen Air Force squadrons would be trained only in a non-flying role, because the complexity of modern aircraft and weapons required full-time specialist training. Sir Frederick also said that a new fighter squadron, equipped with Avon-Sabres, was to be formed at Williamtown, NSW. Aircraft to replace Sabres in the RAAF were expected to become available for delivery within the next three years, and No 10 (MR) Sqn, at present operating Lincolns, was to be re-equipped with Lockheed Neptune P2V-7s.

Room for Aircraft

SPEAKING to No 1024 (East Wight) Sqn of the Air Training Corps on January 29 at their annual prize-giving, Air Marshal Sir Richard Atcherley said it was heartening to hear of the good progress made by the squadron and particularly of its record in providing recruits for the Royal Air Force. With the ending of National Service, the RAF would have to rely on the ATC more than ever. Referring to the "magnificent opportunities" which the RAF offered, Air Marshal Atcherley added: "as far ahead as we can see, the pilot and navigator have a future. The challenge of the missile does not mean that flying machines are out-dated, as there will always be a wide range of jobs which only manned aircraft can perform."

In his report the squadron's commanding officer, Sqn Ldr E. E. Woodhouse, said that during the year 20 cadets left to join the RAF. Against the loss of 59 cadets, there had been a similar number of recruits to keep the strength at 126.

IN BRIEF

AVM A. D. Selway, Senior RAF Officer Scotland, recently presented the Gillan Trophy to No 122 (Glasgow) Sqn of the Air Training Corps.

Lord Carrington, First Lord of the Admiralty, was visiting HMS *Victorious* at sea off the Scottish coast yesterday and today (February 11 and 12) to watch FAA exercises.

AIR COMMERCE

Comet Reliability

THE BOAC engineering department claims that "there has been less trouble keeping the Comet fleet serviceable than with any other new type which the corporation was the first to operate." No restriction of any kind affecting performance was imposed during the first year of operation, according to information released by the manufacturers. The table below lists the 19 *worst* cases of recurrent trouble which have been the subject of modification action. The term recurrent is, say de Havilland, strictly interpreted as meaning more than once: for example, the nosewheel steering bracket failure (item 1) occurred only twice and remedial action was under way before the second failure. There have been no recurrent failures in the tail unit or in the hydraulic power or flight controls. Regarding the latter, the secondary control system has been put into operation on only two occasions, whilst the reserve control system has not yet been used. During the first 12 months of Comet operation no aircraft was ever taken out of service for modification, such work always being absorbed during the routine maintenance cycle.

So far as the engines were concerned, there were ten cases of "airborne ingestion." Four of these involved ice from the front washroom, a trouble which is being put right; one, involving two engines, was caused by trees; and the others were caused mainly by birds. The following data on unscheduled Rolls-Royce Avon RA.29 removals from BOAC's Comet 4s, published by de Havilland, cover the 12 months since services began in October 1958:

Ingestion while airborne, 10; ingestion from runways, 2;

(*Continued overleaf*)

Structure [or System Main Division	Component Giving Recurrent Trouble	Nature of Trouble	Action Taken
1. Fuselage	Windscreen Panels	Various defects including fusing of gold film layer* and delamination	(a) Modification to bus-bar feeding gold film to eliminate hotspots (b) Further manufacturing improvements in hand. Manufacturer's tests and panels in service have already demonstrated improved performance
	Nose-wheel Undercarriage	Steering jack attachment bracket lugs fractured	Bracket strengthened
2. Wing	Front Spar Half-rings	Cracking of rings at spar boom attachments	Modification of design and bolting technique, to obviate possibility of built-in stresses
	Fuel Leaks	Leaks mainly on leading edge, caused by effect of de-icing hot air on the sealant	Different type of sealant substituted to withstand the de-icing air temperatures
	Flap Torque link bolts	Bent when maladjusted	Bolts strengthened and centralized
	Split Flaps	Damaged by water spray when landing on flooded runways†	Flaps strengthened to withstand this type of damage. Behaviour of modified flaps is under observation
3. Electrical System	Alternator	Power failure caused by extreme tropical rain increasing water content of cooling air above acceptable maximum	Shroud fitted over brush gear and slip rings. Tests have shown satisfactory operation
	Alternator	Earth fault on rotor	Modification of rotor windings
	Fuel System Actuator	Corrosion because of ingress of moisture caused by differential pressures	Modification to introduce corrosion-resistant materials and breather. Tests have demonstrated satisfactory behaviour under representative aircraft conditions. Modification embodiment proceeds
4. Air Conditioning and Pressurization	Altitude Selector	Control of rates of cabin altitude change not to desirable standard	Modification and refinement, introducing variable rate-of-change control, has achieved improved performance
	Cold Air Unit	Bearing failures	Service trials with modified units continue, with satisfactory results so far
5. Undercarriage	Brakes	Excessive wear and overheating	Forced air cooling being introduced to reduce consequent temperatures of tyres and hydraulic fluid. Brakes now satisfactory
	Tyres	Undue wear	Maxaret mountings revised to ensure adequate spin-up on touch-down
6. Instrumentation	Fuel Contents Indicator	Adverse effects of condensation§	Modifications introduced to seal connections and tank units to minimize moisture effect. Tests have proved satisfactory
	Fuel Flowmeter	Incorrect integrating action	Modification action taken on transmitter and indicator
7. Fuel System	Refuelling Pipe Coupling	Unable to accept shock pressure	Modification to all couplings prevents disconnection
8. Fire Protection	Fire Warning System	Various	Minor modification to components and installation to avoid Firewire fouls and relay overheating
9. De-icing	Non-return Valves	Instability caused breakage in two cases preventing complete shutting off of system in one wing§	New type valve introduced which on manufacturer's tests has demonstrated an improved performance
10. Galley and Water System	Water Servicing Valves	Freezing caused some delays during transit servicing	Modification action re-positioned valves to warmer areas. Has cut delays by 90 per cent

* Gold film layers between windscreen laminations are an innovation and defects which have occurred may be regarded as an extension of the complete development of the component. † Recent occurrence. § Recent occurrences. N.B. This record covers the period November 1958 to October 1959.

WEST INDIES TEST MATCH

A TEAM of five Ministry of Aviation officials will represent the British side in the forthcoming talks with the Americans in Barbados to review the 1946 Bermuda agreement relating to air services between UK and US territories. The background to this meeting, which will start on February 24 (and which may last about ten days), was discussed in *Flight* for January 1—"From Bermuda to Barbados."

The MoA team will be led by Mrs Alison Munro, and it will comprise A. V. Davies (recently concerned with the Brazilian discussions), D. E. J. Dowler, D. N. Miller, and E. I. R. McGregor, UK civil air attaché in Washington. Representatives of BOAC will be in attendance (since the conflicts to be resolved primarily concern them), and no doubt the West Indies Federation's interests will be represented also.

QUICK REPAIR JOB

THE BOAC Comet 4 which made a wheels-up landing at Rome on December 23, G-APDL, is now back in service. A BOAC working party, assisted by a team of de Havilland service and production engineers, repaired the damage at Rome in 45 days—no mean achievement, and a tribute to the crash-landing characteristics of the buried-jet Comet which should have impressed the underwriters. The cause of the accident, which involved no casualties, is understood to have been attributed to crew error.

The damage was mainly to the centre section and stub wings, and to a lesser extent to the fuselage. The undercarriage doors and the engine cowling doors had to be renewed, and one pod tank and the inboard flaps were replaced. All the engines were changed, the originals being removed for inspection for possible shock-loading damage.

POTENT POTEZ

FOR several years the French Société Henry Potez has made no aircraft of its own design (apart from the prototype Potez 75). But, as already reported, the company now hope to stage a comeback with a very attractive light transport designated Potez 840. Looking rather like a hotted-up Heron, the 8-40 will provide pressurized accommodation for from 16 to 24 passengers and will be powered by four Turboméca Astazou turboprops each rated at 436 h.p. and driving Ratier-Figeac propellers. A one-sixth-scale powered model will go into a tunnel this summer, and the first prototype is to fly at the end of December. The following specification has just become available:—

Span, 63ft 7in; length, 50ft 1in; height, 17ft; wing area, 377 sq ft; basic operating weight, 8,800lb; gross weight, 16,760lb; fuel capacity, 352 Imp gal; take-off run, 1,150 to 1,380ft; runway length (CAR4b), 1,770 to 2,100ft; initial climb, 2,040ft/min (1,260ft/min with one engine out); mean cruising speed, 311 m.p.h.; range, 311 to 932 miles.

Posing for photographs after a flight in the Dart Herald (see "Flight" last week) are, left to right, Sir John Keeling (BEA); Lord Balfour of Inchrye (BEA); A. H. Milward (BEA); E. Manley Walker (Handley Page); R. S. Stafford (Handley Page) and Sir Arnold Overton (BEA). The company say that the Herald should enter service "early next year"

AIR COMMERCE . . .

generator defects, 5; minor defects in the engine ancillaries and accessories and miscellaneous, 13; basic engine defects, 2.

The generator defect has subsequently been rectified and modification action has been taken on the wheelcase trouble—the cause of most of the engine faults. Only two defects in the basic engine led to an overhaul, giving a remarkable unscheduled-overhaul-rate for the basic engine of 0.025 per 1,000 engine flying hours.

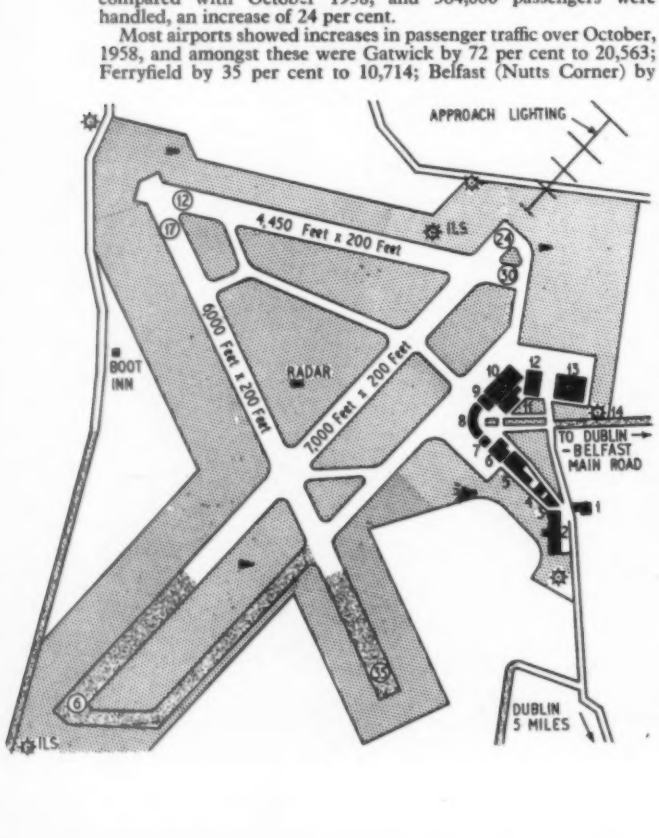
Other defects attributable to the basic engine have been of a minor nature, and have been rectified on site and the engines returned to service. Defects which necessitated engines being returned to Rolls-Royce for rectification amounted to four; only one of these was the responsibility of Rolls-Royce, and another was overhauled only because it was nearly time-expired.

UK AIRPORT MOVEMENTS

MOVEMENTS at UK aerodromes in October 1959 were 28,079, an increase of 16 per cent compared with October 1958. The number of passengers handled increased by 21 per cent to 641,180. Freight picked up and set down amounted to 21,654 short tons, an increase of 56 per cent.

Airports in the London area as a whole showed an increase of 8 per cent in air transport movements, and an increase of 21 per cent in the number of passengers handled. At London Airport there were 10,302 movements, an increase of 9 per cent compared with October 1958, and 364,000 passengers were handled, an increase of 24 per cent.

Most airports showed increases in passenger traffic over October, 1958, and amongst these were Gatwick by 72 per cent to 20,563; Ferryfield by 35 per cent to 10,714; Belfast (Nutts Corner) by 30 per cent to 27,658, Glasgow (Renfrew) by 29 per cent to 46,902, and Edinburgh (Turnhouse) by 28 per cent to 12,540.



Indicated on this map is the changing scene at Dublin Airport. Shaded areas are the new runway and taxiway extensions. Key:

(1) Cornwallis House—administrative offices; (2) Garages; (3) Esso; (4) Irish Shell; (5) Service canteen sections; (6) Cargo and customs; (7) Operations; (8) Central terminal restaurant; (9) North terminal (arrivals); (10) No 1 hangar and engineering offices; (11) Engineering workshops; (12) No 2 hangar (overhaul and engines); (13) No 3 hangar (Boeing 720 maintenance); (14) M/F masts

IMPROVED VANGUARD WEIGHT-LIFTER

A SUBSTANTIAL increase in the maximum take-off weight of the Vickers Vanguard Mk 2 (Rolls-Royce Tyne RTy.11) is announced. Previously 141,000lb, it is now 146,500lb.

The increased weight is useable in the form of extra payload and/or extra fuel. Previous allowance for payload, fuel, crew and catering was 59,840lb; this is now increased to 65,377lb. There are no changes in structure weight (38,094lb) and only a very small increase in weight empty—from 80,314lb to 80,437lb. Maximum zero fuel weight and landing weight are meanwhile believed to have been substantially improved.

In terms of payload-range performance, the increased take-off weight gives an improvement in range with today's maximum payload (29,000lb) of the order of 300 n.m. with full fuel allowances and reserves and cruising at 25,000ft. For example, the 29,000lb payload can be carried for about 1,800 n.m. compared with 1,500 n.m. previously.

NOISE GONE WITH THE WIND

IN its search for ways of alleviating jet noise at US airports the FAA have proposed that take-offs from New York between 10 p.m. and 7 a.m.—regardless of wind direction—should always be made over Jamaica Bay from runway 25L-R, unless the downwind component exceeds 10kt. The FAA is thus responding to public pressures to give legal force to rules similar to those long imposed by the Port of New York Authority (*Flight*, October 17, 1958).

The FAA have also proposed to apply the same rule to Washington Airport but, as might have been expected, objections have been raised by the US Air Line Pilots' Association. Support for the pilots has been voiced by Senator Mike Monroney, chairman of the Senate Aviation Sub Committee, who said that he was inclined to agree that downwind take-offs along preferential runways were "in a direction away from air safety" and that "I do not think this committee is going to be one bit sympathetic with any moves which . . . might . . . compromise safety to solve noise problems."

The Senator's declaration provided the Agency's deputy administrator, James T. Pyle, with the opportunity to answer criticisms of the FAA's inaction over noise abatement procedures while endorsing what Senator Monroney had to say. While the "down-wind" proposal has not been ruled out, Mr Pyle agreed that the rule would not be implemented if it compromised air safety.

IRELAND WANTS COMPETITION

THE car ferries between Ireland and the UK run by British independents should become "one of the major features of cross-Channel travel, both by air and sea." This forecast was made by Erskine Childers, the Irish Minister for Transport and Power in a speech at the annual dinner of the Irish Airline Pilots' Association at Dublin Airport on January 26. "Technical and economic considerations, which are not of our devising, but which are quite understandable, make progress slow," said the Minister. But development of commercial services from such UK centres as Derby, Coventry, Luton and Exeter was essential —"in some cases by competing [with Aer Lingus] carriers." There had to be competition, the Minister added, and he wanted to see more traffic generating more Aer Lingus traffic, "just as a new hotel increases the business of existing hotels."

IS IT BLOCK SPEED THAT COUNTS?

JUST which sort of speed is it that really appeals to Mr Average Passenger? Cruising speed? Timetable speed? Or achieved block speed? If it is the last (and that's the one that provides the chance to boast about journey-time) there may soon be a good many more stories of the "DC-8 is as fast as the 707" type that appeared in *Flight* last week—or like this one from Lockheed, referring to the Electra *vis à vis* the Caravelle:—

"Cases are on record where the Electra, operating over the same route segment, arrived at destination first. One case involved a flight

An event of great significance in Africa: the introduction by CAA of all-African DC-3 Skybus services at very low fares between Blantyre, Nyasaland, and Salisbury. An innovation is the steward or "guide"

between Istanbul and Vienna, a distance of 676 n.m. The Electra took off first with the Caravelle seven minutes behind. Both captains were aware of the competitive aspects of the flight and, while both planes checked in at Vienna control at the same time, the Electra landed ten minutes ahead of the Caravelle. The Caravelle descended from 36,000ft, the Electra from 23,000ft . . .

"A similar situation developed on a flight between Frankfurt and Budapest, a distance of 450 n.m. The Caravelle had taken off from Dusseldorf, and was directly overhead as a KLM Electra was climbing out of Frankfurt. The Electra arrived on the ground at Budapest three minutes ahead of the Caravelle."

For the record, the respective cruising speeds are 405 m.p.h. at 22,000ft for the Electra and 456 m.p.h. at 32,000ft for the Caravelle. Overhauling the other fellow is always a good way to please the passengers and sell the airline, and many an operator has overtaking stories—about DC-6s and Viscounts, Friendships and Convairs and Boeing 707s and Comets. BEA have tales to tell about racing 707s home from Paris to London because their Comet 4B was light and the 707 was heavy, and they were low while the Boeing was climbing. Nevertheless, it is probably going to take a lot of publicity to persuade a passenger—whatever the evidence—that a jet can ever really be slower than a turboprop, however short the stage.

PROGRESS WITH THE 880

THE first Convair 880 continues to undergo the FAA stability and control investigation and demonstrations which it started, ahead of schedule, in December. These may continue until March but thereafter the aircraft is to be taken off flight testing and modified at San Diego into a configuration representative of the Convair 880Ms ordered by Capital. Among the modifications to be made are the addition of wing leading-edge slats, replacement of the existing fin by the one designed for the Model 600, and the addition of a rudder with full power boost. Subsequently, General Electric CJ-805-3Bs of higher thrust will be installed in place of the current CJ-805-3s, and the aircraft will then undergo further flight tests in a programme starting in the late summer. (The engine variant designated -3B has been described as having "4 per cent more thrust for 2 per cent less fuel.")

The second 880, a structural investigation model, has been undergoing static tests for nearly a year, but it is understood that it is now to be converted into a production aircraft, final assembly starting during March. Of the two other 880s being used by Convair for design proving, number three underwent performance tests at Edwards Air Force Base in December and in January was flown to Albuquerque in New Mexico (5,300ft) for investigation of the high-altitude field performance. Finally it will be used for checking out the autopilot system to be employed in Delta's Convair 880s.

The fourth 880 has been used for proving other equipment to be used by Delta, particularly the communications, electrical and navigation systems. Cabin pressurization and air conditioning have also been proved on this machine and now that this is complete the systems are being evaluated by the FAA before functional and reliability tests start next month.

The fifth aircraft is likely to join the fourth in the systems-test programme, probably next month. TWA's communication and navigation systems differ from those of Delta and must be certificated as the result of a separate evaluation.

A NEW APPROACH TO FLIGHT-TIME LIMITATIONS

THE regulations to combat aircrew fatigue, introduced by the Ministry of Transport and Civil Aviation several years ago, were drawn up in the hope of eliminating accidents caused by momentary mental aberration. Unfortunately this aim has been only partly accomplished as the limitations on flight times are too rigid to cover every aspect of every operation. But the utilization of aircrew could be improved, and fatigue reduced, by a more flexible system of approval closely related to aircraft type, the standard of rest facilities available aboard, the time of starting the flight, and crew members' operating watches.

The first obvious factor at present overlooked is the time of beginning duty. Starting at 0600hr and finishing at 2200hr is a reasonable day's work, but a 16hr spell of duty beginning at 1800hr requires sustained effort throughout the night; one crawls heavy-eyed from the aircraft the following day. From discussions with other pilots it seems agreed that one is not tired all the time, but only at times during the night. In the early morning especially, for short periods it is practically impossible to concentrate on anything except staying awake. The obvious solution would be to lie down and sleep, but this is not normally possible.

A second associated factor ignored by the regulations is the human body's inability to store up sleep. There are very few members of an aircrew who can sleep in hotels the afternoon before starting a night flight; as a result, they are tired after being on duty for only a few hours. In a duty span of 16hr rest facilities are not required by law. Most people know how exhausted they become even when resting all day with a book on the beach, indicating that the body uses up its reserves all the time one is awake.

For the 24hr-duty crew, the passenger seats supplied for resting are far from adequate—although their provision is a step in the right direction. In the opinion of pilots who have experienced comfortable bunks one of the most important contributing factors to a complete rest on board is the ability to get undressed and lie full length in clean sheets.

If British aircraft are to compete in the "tramping" business against countries which do not have such stringent flight-time laws a more flexible and medically sound approach is required. Ships do not pull into port each day for the crew to rest, nor should it be necessary for aircraft to do so. The tendency to reduce the number of crew required to fly large aircraft makes easier the possibility of duplicating them into two watches. With this arrangement, and the captain acting as a spare relief without a watch to keep, it should be possible, if proper bunks are installed, to keep an aircraft flying almost indefinitely. The continuity of rest-duty-rest periods would be simpler and long periods on the ground and away from base could be avoided.

The third limitation at present in force which causes long delays and increases instead of removing fatigue is the long rest periods stipulated should the crew exceed a duty day of 16hr. After 12hr rest in bed a crew are not allowed by law to go on duty but must wait several hours longer. As suggested earlier, this waiting increases fatigue and may result in the flight coinciding with the heat of the day and the worst flying conditions in the tropics.

It can be argued that unless regulations are clearly defined and enforced the unscrupulous operator will drive his crews to the maximum, at the expense of safety and fatigue. But if the regulations were modelled on the maintenance system of approval, then all these factors could be allowed for in deciding whether or not to grant Ministry approval to a particular schedule. The advantage of such a system would be its flexibility, since operators who granted the most comfort to their crews could be approved for the longest flight times. If approval were given to the operations manager or chief pilot of each company the quick charter could be handled without loss of time; but if in the opinion of the MoA this privilege were abused then approval could be withdrawn and replaced by strict enforcement of regulations on an hours-flown basis. Sound medical opinion could be used to assist the Ministry staff at arriving at the most desirable operating conditions.

Although bunks in aircraft waste valuable space they eliminate the expense of aircraft sitting on the ground while the crew rest. When the cost is considered of slipping crews, the economics of operation will show in favour of bunks. Bunks would also eliminate the present practice whereby all members of a 24-hour crew claim all the flying time in their respective log books. This makes a mockery of the practice of assessing crew members' ability on their flying experience and increases the cost of operating without achieving higher standards of safety.

Contrary to popular belief, aircrew generally dislike spending long periods in foreign countries. It tends to lower morale and cause unhappiness in the domestic environment. To remain with the aircraft all through the flight has many technical advantages. There is a definite relation between fatigue and morale; a happy crew are the last to show signs of fatigue.

AIRLINE PILOT

AIR COMMERCE . . .

"DIRECT SERVICE"

"THE main objective of this private enterprise helicopter operator," wrote a staff member in *Flight* of January 18, 1957, after an interview with Robert Cummings of New York Airways, "is to get rid of his subsidy just as quickly as he can." In a lecture before the RAeS Rotorcraft Section last week Mr Cummings estimated that NYA's subsidy (now about £800,000 a year or 3s 5d a seat-mile) will be eliminated by 1966.

NYA has just ordered ten multi-turbine (T-58), 25-passenger Vertol 107s to replace the five single piston-engined, 15-passenger Vertol 44s at present operating "direct service" origin-to-destination air transportation in the New York City area.

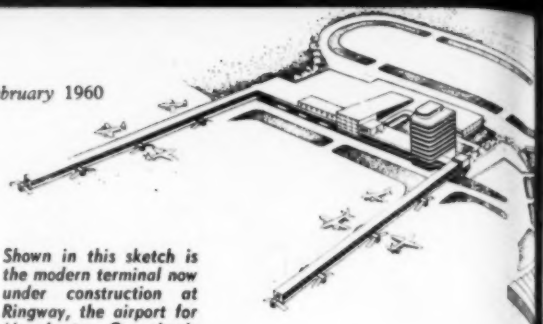
The new 135kt Vertol 107s will come in during the spring of next year. According to figures in an appendix, NYA's estimated subsidy will, by 1963, be down to £432,000, by 1965 it will be down to £183,000, and by 1966 it will be eliminated.

Throughout the lecture, which was short and concise, there was evidence of the environment which has bred the type of helicopter that our own BEA—with its relatively minute background of helicopter experience—now wishes to buy. We quote: "Flying 24 hours a day, in varying weather conditions, has exposed NYA to many of the problems that will be encountered on a larger scale as the scope of our business is increased. It has given us essential information and know-how. . . . By the end of 1963 we expect to be carrying passengers at the rate of 1,000,000 a year. . . . By reducing the average transit time per stop from four minutes to three, the number of seat-miles produced per year [by five 107s] could be increased by some 2,040,000. . . ."

Of the Rotodyne Mr Cummings said: "Its availability in 1964 will place NYA in a position to offer the public a substantially enlarged and even more useful service on a business basis."

BOAC MAY POOL WITH PANAIR

ONE of the surprises resulting from the Minister of Aviation's recent visit to South America (he returned to London on February 7) was the possibility of a pool agreement between BOAC and Panair do Brasil. In one respect negotiations between Duncan Sandys and Brig Correa de Melo, the Brazilian Air Minister, have been favourable: Brazilian quota restrictions on BOAC's fifth-freedom traffic rights in Brazil—which were recently threatened with reduction to one service a week (see *Flight* February 5)—are reported to have been at least temporarily lifted. Discussions were also held, it is believed, on the possibilities of establishing a Brazilian subsidiary for the assembly of British aircraft, possibly the Avro 748.



Shown in this sketch is the modern terminal now under construction at Ringway, the airport for Manchester. One pier is to be used for domestic traffic, the other for international services

Normally, of course, airline pool agreements are negotiated by the operators concerned and only when agreement is reached is the sanction of the governments requested (sometimes). This is the case with the proposed South Atlantic pool between BOAC and Aerolineas Argentinas which is still under negotiation. But the pool with Panair is different, and its consideration by the Minister of Aviation (the initiative is claimed to have come from Brazil) emphasizes the hard political bargaining which is accompanying the corporation's return to South America. Panair do Brasil is the major carrier on the South Atlantic route and this winter is offering 274 seats per week with DC-6Cs and DC-7Cs in comparison with the 122 seats per week being offered by BOAC's Comets.

It can reasonably be assumed that BOAC would only agree to eliminate competition with its Brazilian South Atlantic rival if this were the only means by which a reasonable quota of fifth-freedom traffic could be assured; the high frequency of services offered by the Brazilian national carrier has previously been characterized by generally low load factors on the routes Recife-Dakar and Recife-Lisbon. The agreement proposed is a classic example of the "entry-free" type of pool.

This, then, seems to be the bargain which may be struck by the United Kingdom and Brazilian Governments. Mr Arthur Davies, an Assistant Secretary in the Ministry of Aviation, who accompanied the Comet's inaugural flight to South America, has stayed in Brazil to work out further details of the proposed agreement.

WINGS OVER WESTMINSTER

THE Bow Group—"an independent research society of younger Conservatives"—has chosen this appropriate moment to publish a searching analysis* of Britain's air transport policy. The Bow Group has become widely known in political circles during the past two or three years. Its writings have been acclaimed as being representative of independent political research at its best. During the past year a small sub-committee within the group has been working on a study of Britain's airlines.

A theme that runs throughout the booklet is the need to reduce air fares. The group believes that the primary role of politicians is to secure those conditions where cheap air transport would be welcomed both at home and abroad. In the field of regulation, two recommendations follow closely those advocated in *Flight* last week ("Memo to Mr Sandys"):—

(a) Replacement of the ATAC by a streamlined version of the American CAB which would be independent of the Minister of Aviation.

(b) The conducting of hearings in public rather than *in camera*.

The other recommendations on regulation may be summed up as follows:—

(c) Abandonment of the "sterile concept of material diversion," instead providing the ATAC's successor with more general terms of reference aimed at the orderly development of the industry as a whole rather than mere protection of the corporations.

(d) Introduction of a more satisfactory system of appeal.

(e) Greater control over those regular services which can at present be described as "non-scheduled" and which lie outside the existing machinery for regulation.

(f) Introduction of a general operating licence without which no air services, scheduled or non-scheduled, could be operated (this function, says the group, could well be exercised by an enlarged Air Registration Board).

(g) Adoption of less cumbersome procedures for considering new route applications for scheduled services and inclusive tours.

(h) Compulsory powers to obtain statistics—operational, traffic and financial—from corporations and independents, and the analysis and publication of this information.

The authors recognize that the main problem facing the new licensing authority will be to find a way of allowing the corporations and independents to live and grow together. This will, they say, involve taking advantage of the independents' lower costs and, at the same time, assisting both corporations to cut their cost levels. A whole chapter to this subject alone; this is possibly the most detailed study into the industry's post-war financial record that has yet been published.

Four particular spheres are given as those in which the independents have the greatest scope for scheduled operations: (1) Social services, (2) The corporations' marginal routes, (3) Peak services on highly seasonal routes, and (4) Very Low Fare services. For this last type of operation the group advocates the formation of companies in which corporations and selected independents would participate together: this device would allow independents to work with the corporations in developing VLF services.

Two chapters deal with foreign policy. After a lengthy analysis of traffic rights and bilateral agreements, the group comes out strongly in favour of a more liberal attitude. In those cases where Fifth Freedom rights are not available (or are only obtained after resort to the more labyrinthic forms of international intrigue), the authors endorse adoption of a system involving cash payment for Fifth Freedom traffic rights. There is also a spirited defence of IATA and of pooling agreements. Both these institutions have come in for considerable criticism of late, and for this reason the authors have gone into considerable detail to justify these bodies. In the case of IATA they suggest two radical departures from past policy. The first is for the final sanction of air fares to be taken out of the hands of individual governments and vested instead in ICAO. The second is the adoption of the fare-differential—lower fares for slower services. The main argument here is one that has many times in the past been advocated in *Flight*: such a scheme would allow airlines to escape from the rat-race of quality competition and provide manufacturers with a real incentive to design airliners the primary attribute of which is the provision of low-cost air travel.

Other chapters deal with such subjects as the development of UK domestic services; management and morale; competition from surface transport; airline safety; airport organization; air transport for the armed forces; and the manufacture of civil aircraft. Each of these chapters contains interesting ideas and information, and there are numerous reminders that in air transport you cannot always separate politics from economics. And this, it seems, was where the Bow Group came in.

*"*Wings Over Westminster," published by the Bow Group, 22 St Giles High Street, London WC2. Price 7s 6d (8s post free).*

AIR COMMERCE . . .

ILYUSHIN IL-18 EXPORTS

THE East German Deutsche Lufthansa has signed an agreement with the USSR whereby it will be "supplied with several Ilyushin Il-18s." The first will be put into service from April 1 on the Berlin (Schoenefeld) - Moscow route and, as from May, from Berlin to Bucharest, Sophia and Tirana.

The Communist Chinese airline also now operates Il-18s, and it has been reported that CSA (Czechoslovak Airlines) are planning to introduce the type. There have been no reports that the Polish airline LOT, which may still be in the market for Comet 4s and Viscounts, is planning to introduce Il-18s. But it is also reported that the Rumanian airline TAROM is to take delivery of a number of these aircraft.

Recent reports from Australia suggest that a Russian trade mission has been offering Il-18s for sale at favourable terms. It appears that Russian sales efforts have been meeting with success among the airlines in the Soviet sphere of influence—namely China, East Germany, Czechoslovakia and Rumania, though not yet Poland.

PANAM'S NOISE CONSCIOUSNESS

IN a letter to the *Daily Telegraph*, the station operations manager of Pan American at London Airport, H. H. Elliott, refers to criticisms of the Boeing 707's noise. Specifically he refers to a report that members of the London Airport Consultative Committee felt, after observing two take-offs, that the results were not typical because pilots had been told that their take-offs were being observed. He writes:

"My company makes special efforts to reduce noise on every Boeing 707 departure. Our pilots are carefully briefed prior to all departures to remind them of the importance with which we view noise abatement efforts at London Airport, and to ensure that flight commanders make special efforts to hold noise levels to the absolute minimum.

"In addition, my company engage staff who are occupied solely with the noise abatement programme, and whose main function is to communicate with jet aircraft just prior to and during take-off, giving each pilot a 'countdown' in order to ensure a reduction from take-off power to normal climb power before the aircraft passes over built up areas. We have found this procedure to be extremely effective, as noise level on the ground is related not only to the height of the aircraft above the ground but also to the thrust being developed by the engines when the aircraft passes overhead."

BREVITIES

An air services agreement between Afghanistan and Great Britain is being negotiated in Kabul. The Ministry of Aviation is represented by Graham Wilson.

We record with regret the death of Gp Capt Walter William Deane, personal assistant to Eoin Mekie, chairman of Silver City Airways. He was 63.

A record turn-round for a BOAC Comet is claimed by the traffic staff at Rangoon who recently achieved a time of 26 minutes compared with the normal transit time of 45 minutes.

A prospect for Napier Eland-powered Convair 540s is a new Texan airline (yet to be named) which proposes to operate local services between Dallas, Houston and San Antonio.

Indian Airlines have contracted with Fokker for the purchase of five Friendships for delivery in 1961. The agreement was signed on January 22.

Pakistan International are to operate Boeing 707 services between London and Karachi from March. The aircraft will be leased from PanAm and the service will be operated at an initial frequency of one per week, rising to a three a week by October.

Evidence of Orion Airways' interest in the Avro 748 is contained in an application to the ATAC by the airline to operate this type and DC-3s between Shoreham and Beauvais from May 1, 1961.

The Guild of Air Pilots and Air Navigators announce the award of Master Air Pilot Certificates to Capt Andrew C. T. Evans of Britavia; Capt Bruce M. Taber of Trans-Australia Airlines; and Capt Donald A. Winch, assistant chief check and training captain of TAA.

Legal action has been taken against the FAA by US Air Line Pilots' Association and by Capt Robert G. Chew, an Eastern Air Lines pilot. The latter is asking for a ruling by the Court on the FAA administrator's authority to set a mandatory retirement age (60) for pilots.

An order for five and an option on ten more Allison Super Convairs has been placed by Lake Central Airlines. The first should be delivered in the late summer and services will start 45 days later. Conversion will be undertaken by PacAero. The order includes provision for the overhaul of engines and propellers by Allison on an exchange basis.

West Africa, Equatorial Africa, South Africa, Central and East Africa have all been included in the Avro sales tour being made by K. Edgerton and M. Cooper-Slipper. The team is to go on to Abyssinia, the Sudan and Egypt before returning. Arrangements have been made for the 748 to do tropical and high-altitude trials in Africa in about a year's time.

As a routine procedure the CAB are to appoint a "human factors team" to study each fatal aircraft accident. They will attempt to determine whether any physical disability of the human mechanism may have been a contributory cause, and by studying human aspects attempt to reconstruct the events which led to the mishap.

An amendment to Annex 2 of ICAO's Standards and Recommended Practices has been adopted prohibiting VFR flying at night in controlled air space without the specific permission of the appropriate authority. Though this practice is already illegal in many countries, it was apparently not universally prohibited. It is reported that the amendment was opposed by the US, Canada and Japan.

Latest among the Asian airports for which improvements have been proposed is Singapore. Recommendations made to the Government suggest a 2,000ft extension to the 8,000ft runway, improvements to the approach lighting, new taxiways and aprons, radar installations and hydrant refuelling. A new control tower is to be completed before the middle of the year and this should make the airport "the most advanced air traffic control centre in South East Asia."

Lufthansa 707 services from Frankfurt to New York will start on March 17 and daily non-stop flights on April 1.

The first Boeing 707 services to be operated to New York by Air-India will start on May 14 with three weekly round-trips.

DC-7Cs chartered from Sabena have replaced El Al's DC-6Bs on the Johannesburg - Tel Aviv service and stops have been reduced to one at Leopoldville.

This spring, on a date yet to be settled, BOAC will return to Cairo. Ground handling will be carried out by Karnak, the Egyptian travel and tourist organization, and the corporation intend to reopen an office in Cairo.

Concern is being expressed by the FAA's Bureau of Flight Standards about 707 take-offs through water or slush. It has issued memoranda to its inspectors to ensure that airlines write into their operations manuals precautions against hazardous take-off conditions.

A Lloyd Aereo Boliviano DC-4 on a flight between Cochabamba and La Paz on February 5 crashed shortly after taking off. There were no survivors among the 55 passengers and four crew. All LAB's domestic flights were subsequently cancelled and the airline's office closed for the day in mourning.

Braniff are still considering conversion of their piston-engined Convairs to turboprops. Charles A. Beard, Braniff's president, said recently that a replacement for the Convairs would be needed, but that Boeing 727, Douglas DC-9 or Caravelle jets would be too large for his airline's shorter routes.

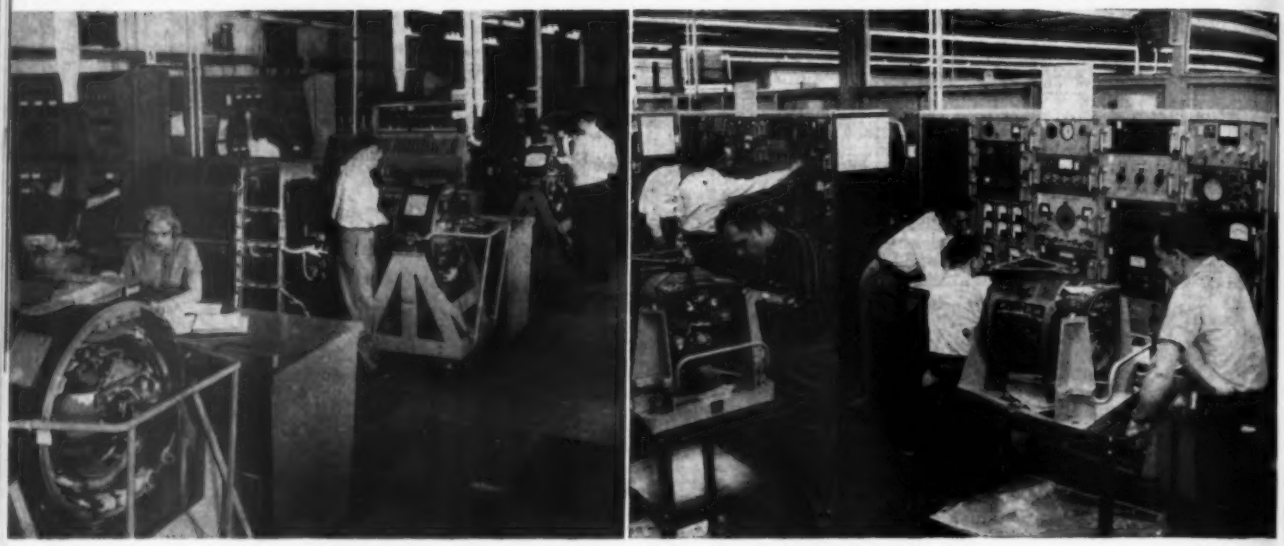
All aircraft flying US jet routes may soon be required by the FAA to carry serviceable radar transponders. This would enable the maximum operating ceiling for civil jets to be increased from 35,000ft to 39,000ft. Clearance at the higher altitudes is being urged by operators of JT4-engined DC-8s and 707s.

PacAero of Santa Monica have received FAA approval for an alternative fuel system for DC-3s and Super DC-3s powered by all Wright R-1820 or C9 series engines. The corporation have modified certain Bendix-Stromberg pressure-type carburettors to prevent icing or freezing of the impact tubes or the boost venturi.

CAB approval has been obtained by American Airlines for the lease from United Aircraft of JT3C-7s for their Boeing 720s and JT3D-1s for their 720Bs. A subsidiary of United known as Amleas will lease on terms whereby American will pay hire charges to the value of the engines ($156,237 for the JT3C-7s and $196,827 for the JT3D-1s) in 28 quarterly instalments, plus interest at 4¼ per cent on the unpaid balance. The annual rental charge will then drop to 5 per cent of the above values. American also has an option to buy the engines outright.

International Aeradio have published a *Handbook of Aircraft Data*. It gives facts and figures about all civil aircraft of all nationalities used for transport, aerial work or business purposes, ranging from the Rawdon T.1.S of 1,900lb all up weight to the Tu-114 which is quoted at 413,917lb, 344 variants in all. Parameters chosen are those considered to be of most use to airport authorities, though it is anticipated that many others will find the Handbook a convenient source of reference. It is obtainable, price 10s 6d, from International Aeradio Ltd, Hayes Road, Southall, Middlesex.

First non-US carrier to open a hangar of its own in New York's great Idlewild complex is Swissair, whose new building is depicted here. It will be used to service DC-8s after their introduction by Swissair in May



Assembly and testing of inertial navigation systems involves elaborate equipment and many different checks. Illustrated above are these procedures being carried out (left) on the stable platform of the AC Spark Plug AChiever guidance system for the Thor IRBM and (right) on the Sperry Doppler-inertial bombing and navigation system for the Convair B.58 Hustler. The hemispherical covers of the AChiever platform are removed to reveal the gimbal rings and gyro mountings. The Sperry platform is rather more compact

FLIGHT SYSTEM SURVEY

BOAC Radio Link

THE BOAC control centre at London Airport is now linked by land-line to the International Aeradio Station at Booker so that captains of BOAC aircraft up to 200 miles away from London Airport can communicate direct with their own operations controllers.

The result of such a direct link is that captains can inform the control centre of the serviceability state of their aircraft some time before landing, thereby avoiding delays in turn-round. Arrangements for special handling of VIP or sick passengers can be made in advance.

Several other airlines, including BEA, employ this technique, using a discrete company frequency.

C.S.F. Radio Altimeter

LATEST version of the radio altimeter produced by the French Compagnie Générale de T.S.F. (C.S.F.) is the AM 220H which is developed for helicopters and low-flying aircraft from the earlier AM 220N. The AM 220H indicates from 0 to 1,000ft to an accuracy better than 3ft or 5 per cent and is fully transistorized with the exception of one transmitting tube. It may also be used for providing flare-out indications during landing and for photographic and geological flying.

The indicator dial includes a pointer and marker showing actual height and a datum selector working in conjunction with luminous or electrical signalling of the chosen minimum height. An output for autopilot or autostabilizer may also be provided. The aerials are enclosed in streamlined plastic fairings and the required power supply is either 22-29V d.c. or 115V, 400c/s a.c. Frequency-modulated signals are transmitted at 1,630Mc/s and maximum allowable deflection from vertical is 40°. Total weight of transmitter/receiver, mounting base, two aerials and indicator is 19.6lb.

Marconi at London Airport

A NEW service depot larger than its temporary predecessor has been opened at London Airport by Marconi's Wireless Telegraph Co. It is in the No 1 maintenance area and is capable of servicing all post-war Marconi airborne equipment to full specification and to ARB approval standards.

Mr J. W. Grandey is engineer in charge and the address is Marconi's Wireless Telegraph Co Ltd, Service Depot, Sections A and B Building 201, No 1 Maintenance Area, London Airport, telephone SKYport 1039.

Components of the French C.S.F. AM 220H low-level radio altimeter. The transmitter/receiver is transistorized, weighs 15lb and is made up of four plug-in modules. Mounting bases suitable for either fixed-wing or helicopter installations can be provided. The AM 220H can be used with auto-flare systems

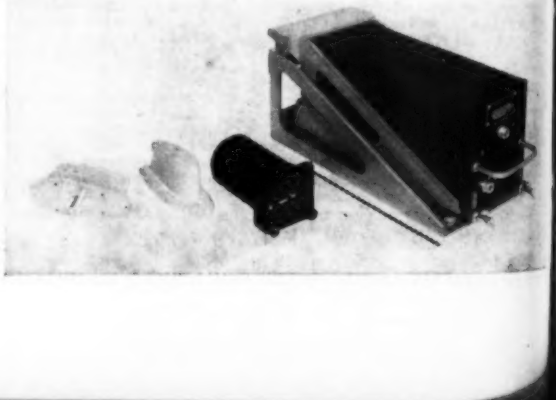
Field's Bendix Sales and Service

SALES and service for a wide range of Bendix Aviation Corp products in the United Kingdom is offered by Field Aircraft Services Ltd at London Airport. The company, in fact, represents seven of the Bendix divisions responsible for producing such items as the Bendix radio compass, weather radar, VHF communications and navigation equipment, generators and inverters and other items. Field are also sole UK sales representatives for those items of Bendix radio equipment produced under licence by Elliott Brothers (London) Ltd. Certain Bendix equipment, including radio and radar, can therefore be offered from English sources. Radio and radar overhaul facilities are available at London Airport and at Bovingdon.

A number of aircraft have already been fitted with Elliott-made Bendix 21-series light-weight VHF equipment and final ARB approval is expected in the near future.

Ekco CRDF

A TEST report on the performance of the Ekco CE178 cathode-ray direction finding equipment as originally installed at Southend airport has now been issued by the Ministry of Aviation. The CE178 provides a reliable, accurate and cheap DF facility for small airports. Since the original installation, the equipment has been ordered for Leeds/Bradford airport at Yeadon, the Pressed Steel Co at Kidlington, Westland Aircraft at Yeovil and by International Aeradio Ltd for Benina airport, Benghazi.



Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Australian FAA Future

THE announcement that the Australian Fleet Air Arm is to be disbanded in mid-1963 poses certain doubts in my mind as to the motive. This is said to be that up-and-coming combat aircraft need a bigger and faster aircraft carrier, which Australia cannot afford.

The use of the Etendard IV presumably has been considered. Dassault have stated that it will be suitable for use from "small aircraft carriers," and doubtless had such vessels of the Commonwealth navies and Brazil, Argentina and the Netherlands in mind. If these vessels are too small and slow, this will be a serious blow to Dassault and to the respective navies.

The biggest surprise is that the idea of using HMAS *Melbourne* as an anti-submarine/Commando carrier unit has been rejected. With a complement of S-61s she could be a very valuable unit in the Far East. Such a ship exists of course in HMS *Bulwark* and it is rumoured that *Albion* will be similarly converted.

It is fair to assume that one of the reasons for the Canadian Navy's interest in the Sikorsky HR2S is to prolong the useful life of HMCS *Bonaventure*, a carrier of similar speed and dimensions to the Australian vessel.

Totland Bay, IoW — GRAHAM STALLARD

Violent Manœuvres

THE recent announcement by one of the larger US airlines that "stall checks and other 'violent manœuvres' (asymmetric?) will no longer be carried out," presumably due to the large and inherently destructive loads thereby placed on airframes, leaves me—and I imagine a few other people—wondering as to the facts.

Slide-rulers forward, please. For myself, with only military background for experience (dare I speak?), I always understood that all aircraft were adequately stressed for such loads.

Surely a good old-fashioned "crump-on" landing of a 75,000-pounder on to very unyielding concrete produces a much greater spar-bending load?

For the last few years, as a multi-engine instructor, I have gaily cavorted around the blue—stalling here, feathering there, etc. All this in aircraft some of which are well past the "key of the door" age.

Barnehurst, Kent — BLISSFULLY IGNORANT

Alconbury in Wartime

IN *Flight* for January 29, under the heading "Based at Alconbury," Humphrey Wynn states ". . . the first wartime operations from Alconbury being undertaken by Wellingtons of No 40 Sqn on detachment from Wyton."

I would like to correct Mr Wynn on this point. The type of aircraft concerned were Blenheims and the squadron was No 15, which was at the time sharing Wyton with No 40. No 15 changed over to Wellingtons during November 1940 and was operational again early the next month.

Leicester — C. B. PICKERING,
Ex-Nav/BA, No 15 Sqn, 1940 to 1941

[Humphrey Wynn comments: "Mr Pickering obviously has first-hand knowledge on this point. My information, from official sources, made no mention of No 15 Sqn."—Ed.]

Surviving Martinsyde

AS it has been considered that a most fitting tribute to that notable early pioneer, the late G. H. Handasyde, would be the restoration of one of his famous creations—a Martinsyde F.4—the immediate task has been to ascertain if an F.4 or any other Martinsyde aircraft still exist. Although it would seem that none is available in this country, I am pleased to say an F.4 still survives in Finland and that I have been endeavouring to see if it could be brought back here—so far without success.

This F.4 is the property of the Finnish Air Force. It was one of 15 Martinsydes which were purchased in 1923 and on which the first regular fighter pilot course was begun at Utti—the cradle of Finnish fighter pilots at that time. It is of interest to mention that the last Martinsyde flew as late as in 1938 at the Air War School at Kauhava, making aerological flights and even doing aerobatics.

While the Finns have expressed their appreciation of the idea of a Martinsyde tribute and have checked the possibility of finding another such aircraft, they regret that as this 1938 machine is their last Martinsyde, and they wish to retain it for their war museum, they are unable to release it.

In view of the important role that these aircraft played in the building up of the illustrious Finnish Air Force, I feel that the question of a "double tribute" might now be a matter for consideration—a joint tribute to Mr Handasyde and the Finnish Air Force. Should it be possible to make this Martinsyde airworthy, it would certainly be a historic and outstanding feat to fly it from Finland to here, perhaps even qualifying for a £10,000 prize. I mention this as the death of Mr Handasyde occurred on the eve of the Blériot jubilee year, and it is a coincidence that he constructed his first machine just over 50 years ago, in 1908. Also, a Martinsyde F.5 held the London - Paris record in 1919—hence the suggestion.

Perhaps it might still be possible to learn that another Martinsyde still exists. What became of the Semiquaver, which carried off the British speed record? Lastly, I would be very glad to hear (c/o the Editor) from any ex-Martinsyde personalities.

Edinburgh 7 — S. H. HANDASYDE

Airplane versus Aeroplane

PERHAPS a little-known war story might give your columnist Roger Bacon some indication of higher thought given to the above controversy. Lord Beaverbrook was appointed Minister of Aircraft Production in June 1940. Some nine months later the full significance of this appointment dawned on the Air Ministry, and it was decided to investigate the credentials of this noble lord; naturally, a copy of the *Daily Express* was examined as an example of his many interests. Upon discovery of the use of the word "airplane" therein, strong representations were made to the Prime Minister that a person holding high office could not spell correctly the object of his department's function. The PM, himself a master of English usage, could only agree; and Lord Beaverbrook, in the terms of Cy Caldwell, was fired.

Bournemouth, Hants — W. G. COX

[Undoubtedly apocryphal, like most of the other stories of "The Beaver's" eventful tenure of office at MAP; but worthy of repetition nevertheless.—Ed.]

Big Jet Noise

BEING one of many thousands of people now showing a noticeable interest in aircraft noise abatement, I'm afraid I cannot turn a deaf ear to the latest move against these developments.

It seems as though not only the complainants living around London Airport are to leave their homes through this nerve-grinding, head-splitting jet noise, but also certain members of the Cornish community who are staging a fight against future BOAC plans to operate the Boeing 707 crew training programme from RAF St Mawgan, a mere two miles from the popular holiday resort at Newquay.

You may consider that local inhabitants of Newquay and surrounding district have grown accustomed to such noise, for over the last few years RAF Shackletons—and before them, Lancasters—have been constantly buzzing the area.

Maybe this is so, but when the 707 arrives on the scene attitudes become different. What person in any frame of mind can live in peace and solitude with such onslaughts of noise continually passing overhead?

People like the LAP residents have worn this noise for just too long and now that the big jets are taking the field the pressure is becoming much too great for them. Some effort must be made to harness this noise. Instead of meetings to discuss certain aspects of the problem and the inevitable complaining, let us please see something developing.

Walsall, Staffs — A. K. DOLPHIN

FORTHCOMING EVENTS

Feb. 12. RAeS Agricultural Aviation Group: "Choice of Aerial Vehicle," by F. R. J. Britten and D. F. Myres.
Feb. 16. Photogrammetric Society: "The Re-survey of the Highlands by Photogrammetric Methods," by Maj A. J. D. Halliday.
Feb. 17. RAeS (Main Lecture at Bristol Branch): "Firestreak," by G. H. F. Brown.
Feb. 17. Aircraft Recognition Society: Monthly Recognition Contest and talk on Woomera by E. A. Wren.
Feb. 18. RAeS Astronautics and Guided Flight Section: "Missile Control Problems," by D. Best.
Feb. 19. Institute of Navigation: Discussion on Space Navigation, introduced by Dr J. G. Porter.
Feb. 22. RAeS: Trenchard Memorial Lecture (at Halton Branch), "A Dip into the Future . . ." by Sir George Edwards.
Feb. 23. Institute of Transport (West Middlesex Group): "Aircraft of the Future," by R. C. Morgan.
Feb. 23. RAeS: "Theory and Practice in Structural Problems," by A. J. Troughton.
Feb. 23. British Interplanetary Society: "Some Problems Encountered in the Design of Large Rocket Test Beds," by R. H. B. Forster and L. Breen.
Feb. 23. Guild of Air Pilots and Air Navigators: Banquet.
Feb. 23. RAeS: "Relationship between Theory and Practice in Structural Problems," by A. J. Troughton.
Feb. 24. RAeS Man-powered Aircraft Group: "Natural Flight," by Peter Scott.

RAeS Branch Fixtures (to Feb. 19): Feb. 17, *Preston* (Joint lecture with Institute of Welding), "The Application of Special-purpose Machine Tools," by I. T. Clowes; *Southampton*, "Some Aspects of Yacht Performance Analysis," by P. Crew; *Weybridge*, "Supersonic Transport," by P. A. Hufton.

THE INDUSTRY

Cellon's New Facility

THE old-established firm of Cellon Ltd acquired what should prove a valuable addition to their Kingston-upon-Thames works when, on Tuesday of last week, the opening of their new paint application laboratory was celebrated by a luncheon at which the guest of honour was John Boyd-Carpenter, Minister of Pensions and MP for Kingston. Introduced by the company's chairman, J. Duncan Ferguson, Mr Boyd Carpenter spoke of "two great concerns which have played a vital part in the life of the Royal Borough of Kingston" (across the road from the Cellon works is the vast new administrative building of Hawker Siddeley Aviation). As a result of their close association with the aircraft industry, said Mr Boyd Carpenter, Cellon had found a continual need for developing new processes, a way of working essential to the nation's life as a whole: in view of Britain's lack of natural resources, it was vital that we should keep in the forefront of technological progress.

For many years—in fact, since the end of the 1914-18 War—the company has also been a producer of paints other than aircraft finishes, and the new laboratory is primarily concerned with these wider products; even so, much of the work done there should be of benefit to the aircraft industry, and to the components and equipment side of it in particular. Very briefly, the aim has been to solve customers' problems by installing finishing equipment of the kind which the customers themselves are likely to be using. Examples include hot- and cold-spray plants for wood finishing; electrostatic spraying equipment; and a range of stoving ovens, including an infra-red oven and a large gas-fired camel-back oven, both with conveyor systems.

Following the recent reorganization in the company's board (when A. Wallace Barr became managing director in succession to W. J. Shilcock on the latter's retirement after 46 years with the company) another appointment to the board was announced last week—that of Wg Cdr J. C. Cantrill. With service in both wars—he was an RFC fighter pilot in World War I—Jack Cantrill joined Cellon in 1930 after test flying for Avro, and as the sales manager of the company's aircraft finishes division has for many years been a well-known figure in the industry and around the flying clubs.

Way to the Top

IN his speech to Handley Page apprentices at their recent annual prizegiving the Parliamentary Secretary to the Ministry of Education, Kenneth Thompson, MP, suggested that other companies should follow the Handley Page example in expanding apprentice training—increasing the number of apprenticeships from 60 in 1945 to 280 at present and making available seven different training schemes. "It is difficult to see how any firm could do more," he said. He also referred to the fact that a third of the company's technical staff and eight senior executives were ex-apprentices. "This shows," he said, "how the way is open to the top."

The company's technical director, R. S. Stafford, reviewing the past year's work (in the absence of Sir Frederick Handley Page) said that the company was pleased by the long waiting list for apprenticeships; and Dr J. S. Tait, principal of Northampton College of Advanced Technology, announced new facilities for apprentice training. In the past few years his staff had doubled and plans were in hand to double the size of the College.

New Aluminium Company

A NEW company, James Booth Aluminium Ltd, was recently formed by the Delta Metal Co Ltd to acquire the whole of the aluminium and light-alloy interests of its existing subsidiary James Booth & Co Ltd. Of the new company's issued capital of £10m, Delta is contributing £5m by way of existing assets and Kaiser Aluminum & Chemical Corporation £5m by way of additional finance. This money will be used to expand and re-equip the Booth works at Birmingham, which among other output will produce specialized lines like Duralumin with which the company's name has been particularly associated in the past.

Management is to remain in the hands of the Delta Group, with the following board members: W. E. Ogden (chairman of the Delta Metal Co Ltd), chairman; W. W. Dolton, W. J. Vaughton, A. F. Thomas and D. H. H. Clarke from the Delta Group and D. A. Rhoades, T. J. Ready and A. H. Branstad from Kaiser Aluminum. W. J. Vaughton has been appointed managing director and A. H. Branstad assistant managing director. Sir Horace Clarke, present chairman of James Booth and Co Ltd, has been invited to become honorary president. The Delta announcement of the new company's formation says that provision has been made to see that control of it "will not pass out of the UK."

At the Cellon laboratory inauguration (see first news item): left to right, F. Fancutt, chairman of BSI pigments, paints and varnishes industry standards committee; Dr W. J. Bushell of Courtaulds Ltd, deputy chairman of Cellon since they joined the Courtaulds group; John Boyd-Carpenter, MP, the guest of honour; J. Duncan Ferguson, Cellon chairman; and J. T. Lidbury, joint managing director of Hawker Siddeley Aviation and managing director of Hawker Aircraft

Aluminium Merger Appointments

A JOINT announcement from Reynolds T.I. Aluminium Ltd and the British Aluminium Co Ltd states that plans for the merging of the resources of the two companies are now well advanced, and that the following board appointments—which cover the operations of both—are effective from February 1: Gerald Lacey (commercial director, British Aluminium Co Ltd) to be executive director, forward planning; G. A. Anderson (director and general sales manager, British Aluminium) to be director of products and development; Basil James (chief executive [sales], Reynolds) to be director of sales; J. Salter (director and general production manager, British Aluminium) to be director of engineering; Paul R. McGehee (chief executive [production], Reynolds) to be director of production, manufactured products; and W. B. C. Perrycoste (director and general production manager, British Aluminium) to be director of production, primary products.

IN BRIEF

Sir Walter Worboys has been elected to the board of BTR Industries Ltd and appointed a deputy chairman.

F. W. Holmes has been appointed projects manager of Ultra Electronics Ltd. He has under his control several project teams, each of them responsible for the sales, engineering liaison and progressing of their particular product.

Following the recent announcement of an MoA contract for 25 Pyrene crash tenders, there comes news that a Russian ship recently sailed from London carrying among her cargo a Pyrene Mk 6T airfield crash tender ordered by the USSR Trade Delegation in the UK.

Dudley S. G. Honor, who for the past seven years has been Latin American representative for the Bristol Aeroplane Co, has been appointed company representative in Latin America for Canadair Ltd. A former group captain in the RAF, he held diplomatic posts as military and then civil air attaché in South American countries after the Second World War.

AVM W. A. Opie, CB, CBE, who retired from the RAF in June last year, has been appointed to the board of Irwin Technical Ltd. From 1952 to 1953 he was Director of Servicing, Research and Development at the Ministry of Supply, becoming Assistant Controller of Aircraft in 1953. His last RAF appointment was that of AOC No 41 Group.

W. D. H. Gregson, DFH, AMIEE, former London manager of Ferranti Ltd, has now taken up a new post as assistant general manager of the company's Scottish group. This employs over 3,000 personnel in its Edinburgh and Dundee factories, which develop and manufacture weapon systems, gun sights, radar and specialized electronic equipment, machine tool control systems, inertial navigational instruments and equipment for vacuum physics.

Following a recent visit to Norway by W. H. Dothie, export sales manager of Firth Cleveland Instruments Ltd, the firm of A/S Garek have been appointed Norwegian representatives for the Gilbarco-Firth Cleveland electronic tank-contents gauge. Other news from the Firth Cleveland Group is that Simmonds Aerocessories Ltd have formed a company in Western Germany, in association with Mecano-Bundy GmbH of Heidelberg for the manufacture and sale of Spire Speed Nuts and other fastenings.

W. P. Calvert, who had been director and general manager of Rolls-Royce of Australia Ltd since 1957, retired early in January after a lifetime spent in aviation. He served his apprenticeship at the Royal Aircraft Factory and in the First World War was with the RFC and RAF, qualifying as a pilot. After the war he was employed by a number of pioneer airlines, notably Air Transport & Travel, KLM and Daimler Airways. He was with the Fokker company for a time before joining D. Napier & Son Ltd, where he was associated with the late Maj Frank Halford on the development of the Rapier and Dagger engines. Mr Calvert joined Rolls-Royce as a service engineer in 1937 and as manager of the aero service department was directly responsible for building up the company's world-wide service organization.